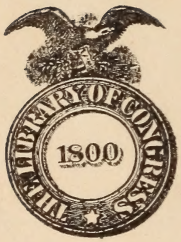
SB 354
.C15
ed. 34
1908
Apr.
28-May 1
Copy 1

Thirty-Fourth Fruit-Growers' Convention

HELD AT RIVERSIDE

APRIL 28 to MAY 1, 1908


THE LIBRARY OF CONGRESS
1800

OFFICIAL REPORT

OF THE

THIRTY-FOURTH FRUIT-GROWERS' CONVENTION

OF THE

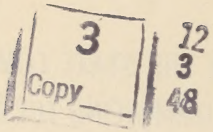
STATE OF CALIFORNIA,

HELD UNDER THE AUSPICES OF THE STATE COMMISSION OF HORTICULTURE, AT RIVERSIDE, COMMENCING TUESDAY, APRIL 28, AND ENDING FRIDAY, MAY 1, 1908.



SACRAMENTO:
W. W. SHANNON, : : : SUPERINTENDENT OF STATE PRINTING.
1908.

SB 354
.C1E



2 5-43-9

CALIFORNIA STATE COMMISSION OF HORTICULTURE.

J. W. JEFFREY, COMMISSIONER.

JOHN ISAAC, *Secretary.* GERTRUDE BIRD, *Stenographer.*

MAIN OFFICE:

State Capitol, Sacramento.

QUARANTINE DIVISION.

E. M. EHRHORN, *Deputy.* O. E. BREMNER, *Assistant Deputy.*

OFFICE:

Ferry Building, San Francisco.

INSECTARY DIVISION.

E. K. CARNES, *Supt.* GEORGE COMPERE, *Collector Beneficial Insects*

OFFICE:

Capitol Grounds, Sacramento.

TABLE OF CONTENTS.

PROCEEDINGS OF FIRST DAY.

Morning Session—

PAGE.

ADDRESS OF WELCOME. By S. C. Evans..... 7
ADDRESS. By Hon. M. Estudillo..... 9
OPENING ADDRESS. By J. W. Jeffrey..... 10
ADDRESS OF DR. DAVID STARR JORDAN..... 17

Afternoon Session—

WALNUT CULTURE AND TOP-GRAFTING. By J. B. Neff..... 19
ADDRESS OF PROFESSOR RAMSEY..... 25
THE PRESENT AND FUTURE STATUS OF OUR GRAPE INDUSTRY. By O. E. Bremner..... 30
PARASITES AND THE STATE INSECTARY. By S. A. Pease..... 39
PARASITIC CONTROL OF INJURIOUS INSECTS. By Prof. A. J. Cook 49

PROCEEDINGS OF SECOND DAY.

Morning Session—

THE PROPER HANDLING OF CITRUS FRUITS. By J. H. Reed..... 56
THE HANDLING OF ORANGES IN 1908. By G. Harold Powell..... 59
PACKING HOUSE EQUIPMENT. By C. E. Rumsey..... 66
THE CITRUS PROTECTIVE LEAGUE. By E. M. Lyon..... 71
ADDRESS OF C. C. CHAPMAN..... 74
ADDRESS OF A. G. KENDALL..... 75

Afternoon Session—

HEALTH AND DISEASE IN THE CITRUS TREE. By Prof. Ralph E. Smith 79
THE CALIFORNIA LEMON. By C. C. Teague..... 93
GROWING INTEREST IN LEMON CULTURE. By R. C. Allen..... 97
THE UNIVERSITY FARM SCHOOL. By Prof. E. J. Wickson..... 99

PROCEEDINGS OF THIRD DAY.

Morning Session—

INVESTIGATION OF THE USE OF HYDROCYANIC ACID GAS IN FUMIGATING CITRUS TREES. By R. S. Woglum..... 103
SULPHURED FRUIT AND ITS RELATION TO THE NATIONAL PURE FOOD LAW. By Arthur R. Briggs..... 118
SOME RELATIONS BETWEEN SOILS AND FRUITS. By Prof. W. W. Mackie 127

Afternoon Session—

PAGE.
WHAT IS THE TRUE VALUE OF A CERTIFICATE IN SHIPMENTS OF NURSERY STOCK. By C. E. Bemis..... 139
CAUSES OF NEW INFESTATIONS. By P. D. Fowler..... 143
QUARANTINE BETWEEN CALIFORNIA POINTS. By R. P. Cundiff. 149

PROCEEDINGS OF FOURTH DAY.

Morning Session—

REPORT OF COMMITTEE ON RESOLUTIONS—
FAVORING THE APPOINTMENT OF COUNTY HORTICULTURAL COMMISSIONS 157
INDORSING THE CAMPAIGN AGAINST THE WHITE FLY..... 158
INDORSING THE WORK OF G. HAROLD POWELL..... 158
INDORSING THE STATE UNIVERSITY AND PROFESSOR WICKSON..... 158
IN FAVOR OF INSPECTION OF PLANTS PASSING THROUGH THE MAILS.... 158
FAVORING WOMAN SUFFRAGE 158
OF THANKS 158
REPORT OF COMMITTEE ON PRESIDENT'S ADDRESS..... 159
MAINTAINING THE FERTILITY OF THE ORCHARD. By Frank L. Palmer 160
DATE GROWING IN SOUTHERN CALIFORNIA. By Silas C. Mason 170
SOME POINTS IN THE HISTORY OF CAPRIFICATION IN THE LIFE HISTORY OF THE FIG. By Walter T. Swingle..... 178
THE EUCALYPTUS, FOR USE AND ORNAMENT. By F. P. Hosp.... 187

PROCEEDINGS

OF THE

THIRTY-FOURTH CONVENTION OF THE CALIFORNIA STATE FRUIT GROWERS.

RIVERSIDE, CAL., April 28, 1908.

Pursuant to call, the Thirty-fourth Fruit-Growers' Convention met at the Loring Opera House, Riverside, Tuesday, April 28, 1908, at 9:30 A. M.

J. W. JEFFREY, State Commissioner of Horticulture called the meeting to order.

REV. ALEX EAKIN, of Riverside, opened the Convention with an invocation.

PRESIDENT JEFFREY. We are now ready for business, and the next on the programme is an address of welcome to the visitors and members of this Convention by the Hon. S. C. EVANS, Mayor of Riverside. (Applause.)

ADDRESS OF WELCOME.

BY S. C. EVANS, MAYOR OF RIVERSIDE.

I don't know of any subject that could be of more interest to the people of Riverside than the subjects that will come before a Convention of this kind, and it surely behooves the people of Riverside and of all Southern California to seriously consider the questions that will come before you.

I don't know what more I can say than to indicate that in some lines particularly, perhaps in the lemon industry, the tendency of late years seems to have been—perhaps it is a necessity to achieve best results—to have the holdings in large tracts of land, so that the market can be supplied through all the months of the year, and the lemons properly handled and cured by those who are expert in that particular line of business. And as we notice the drift of things, many of our orange groves are going into large holdings, through combinations of people and companies or corporations. Perhaps the best results come through that method of handling, as illustrated in the packing-house system of our Fruit Exchange. Of course the citrus industry is our mainstay. It is very profitable. A good orange grove is better than anything else in a money way—a poor one is a source of aggravation all the time; but it seems to me that we ought to encourage the small grower in the small fruits—anything that can be grown and produced, berries, vegetables, all small fruits—and get as many people settled upon the land and on the small tracts as possible. I know in this southern part of the State where water is fairly scarce, and sometimes very hard and expensive to bring upon the right kind of soil, that it is hard to

divide it and subdivide it into small tracts and give proper water delivery where a man can make a living.

This thing of growing fruit and farming is not all that it is cracked up to be. Sometimes a man makes a very poor stagger at it, like I do, sitting on a stool in an office and trying to farm. Usually we pay for the experience, and we don't get very much revenue in return. But a man who can go on a place and live and farm it ought to be encouraged. We ought to encourage the small fruit industry as well as the big one.

The people are settled throughout our city and throughout our State on small tracts. Upon them we have to depend mainly for the public sentiment that creates and makes it easy to accomplish our public improvements, such as tree planting, good streets, and things of that kind. Where one or two men, or a company, many of whom are not living upon the tract, have large holdings, they have very little interest in such things. Sometimes they are willing to pay for them, but they have not the same personal interest in the public improvements that we so much enjoy in this city, although we have not made very great progress in them yet.

So if there is one thought I can leave with this Convention, it is to settle as many people as you can on small tracts, and encourage the small industry. I don't know how you will do it, but probably the question will be solved.

Now, on behalf of the people of Riverside, I welcome all the strangers that are with us, and I am sure you will find that welcome doubly expressed in the ability of our people who are among you in this Convention to show you about our city. I am sure you could not have arrived here at a more pleasant time, for everything is now at its best, and you could not have seen things at a better time than to-day. I hope you will have an exceedingly pleasant time in our city, and I welcome you to it. (Applause.)

PRESIDENT JEFFREY. The speaker has certainly given some good advice, and his remarks will be in the library of every institution in the State inside of a couple of months. I hope you will all remember that you are not talking for a little Convention of fifty people. After to-morrow we will have three or four hundred. You are really talking for the permanent literature of the State, and what you say should be delivered with that idea in view. We have now in my office in Sacramento hundreds of copies, nicely bound, of our last Convention reports. It will be the same with this Convention; and we are glad that the Mayor has given us good advice, especially in the matter of small holdings. Something may develop later in this Convention to show what the people of the city of Riverside owe to the orange growers of Riverside and to the lemon growers, what the business men here owe to these people; and the more of those orange growers there are, the better for the business men of Riverside.

As you know, Governor Gillett has been very ill, and very busy even during his illness. When it came time to think of this Convention, he sent word that he would delegate somebody to come and represent him, and he chose Mr. M. Estudillo, one of your fellow citizens. I am very pleased now to introduce to you, as the representative of the Governor on this occasion, Mr. Estudillo.

ADDRESS.

By HON. M. ESTUDILLO, representing Governor J. N. Gillett.

Mr. Chairman and Gentlemen of the Convention: "A farmer," says Bryan, "is a man who makes his money in the country and spends it in the city, and a horticulturist is a man who makes his money in the city and spends it in the country." The Governor is in thorough sympathy with you and keenly interested in your efforts. He takes a personal interest in the welfare of the horticultural and agricultural interests of this State. Every bill that came before the Legislature, which had a tendency to help those interests, received his support. The Davisville Farm, the Agricultural College, and our own Experiment Station received the Governor's cordial support. In fact, the Governor has shown beyond a shadow of a doubt that he is a true and enthusiastic friend of the fruit industry of the State.

If further evidence should be required regarding the Governor's interest in the fruit industry of the State, I would refer you to the appointment of the Hon. J. W. Jeffrey as Horticultural Commissioner of California. A word in reference to Mr. Jeffrey. I wish that he were not present, for being a modest, unassuming man, I am afraid he would blush like a sixteen-year-old maid. If he were not present, then I might say all the nice things I wished about him.

Gentlemen, this is a grand State, this glorious California of ours—a grand Empire nestling on the shores of the bluest of oceans, the Pacific. I realize that the people have different problems in the different parts of the State to solve. You fruit men, together with the rest of the people, have problems to solve other than fighting insect pests, the fertilization of the soil, markets, the best methods of packing and transportation. And these problems, I repeat, are different in different parts of the State.

In the northern part of the State it is how to break up these princely principalities into smaller homes; how to make them produce and support millions where they now support thousands; how to harness the streams that now flow unchecked in their mad career to the sea; how to make them light your towns and cities, do your bidding, turn the wheels of commerce; how to reclaim the vast inland seas and make them blossom forth as the rose; how to force a small tract of land to support a family where it requires a thousand acres to-day. These are some of your problems in the north.

Here in the south the problems are: How to cause a spear of grass to grow where none grew before; how to garner the precious drops of water, how to conserve them; how best to tap nature's underground supply, and how to thwart nature's thirstbeams after the water comes to the surface; how to make a foot of land support a family; how to turn the desert, sands, and the rocks into gold, milk, and flowers.

Believing that the fruit industry should have every means of protection I would suggest that you ask your Legislature for adequate appropriations in the future. You should advise and confer with your representatives regarding your needs. I believe that the time has arrived when more money should be placed at the disposal of the office of the Horticultural Commissioner, for you can never tell what

emergency may arise. Fighting the white fly in the northern part of the State alone cost $20,000. Surely the State can not spend money more judiciously or to better advantage than in fighting the pests that threatened her greatest industry.

OPENING ADDRESS.

By J. W. JEFFREY, State Commissioner of Horticulture.

Ladies and Gentlemen, Members of the Thirty-fourth Fruit-Growers' Convention of California: One who can stand before the fruit growers of Southern California and the other horticultural experts of the State and address them upon their own business affairs without a feeling akin to panic, must either know them as I do, or have a great deal of ignorant assurance to undertake the task. I can not plead ignorance of what the people will stand for, and must rely upon long acquaintance and what I may say to them for the fair hearing which I know will be given this morning. Twenty years ago this month Riverside was honored for the first time by a visit from the present State Commissioner of Horticulture. I was an ambassador of no mean pretensions, for I had with me the entire navel orange crop of the San Gabriel Valley with which to astonish the natives of Riverside at their citrus fair. Like Artemus Ward, who loyally offered to immolate all his wife's relatives upon the altar of his country, the people of my valley were willing to sacrifice their every orange to give publicity to their town sites, and as the bearer of these fruits I expected attention in proportion to the disinterested surrender of crops my people had made. The exhibit when in place consisted of a pyramid eighteen inches square at the base and a plate of fruit at each corner. After looking over the Riverside tables I decided that the fewer specimens I put up the better my exhibit would appear, and I chucked the balance of the three boxes under the table. My offering was finally smoothed up to public view, and I stood back to see the nearby glory of the fruit of Twogood and Cutter reflected from the prisms of my alligator-skinned oranges, and to await the rush of approval toward my table. It didn't come, though an occasional visitor in pity lingered a moment to hear of the wonderful citrus possibilities of the upper San Gabriel Valley, which I may say have since been fulfilled in a measure that my ripe experience of ten months in the State could not even foreshadow. By the end of the week I had eaten the whole output of the San Gabriel Valley with the relish distinguishing a tenderfoot, and cast about for some way to get even with Riverside for not noticing my exhibit. Knowing that L. M. Holt was gifted in expressing the wonders of California's products, I paid him $60 for an editorial column of appreciation, and the next morning it was seen that my exhibit had eclipsed anything at the fair. When I returned home the weight of my newspaper testimonials was greater than that of the fruit which had brought out such modest notice. It was the first time I had ever subsidized a newspaper, and for years it worried a tender conscience to have imposed upon so guileless a community as the Riversiders then seemed to be. I knew they would not resort to such questionable expediency to boom their citrus fruits.

About three years ago my conscience ceased from troubling. At that

time I had written about the wonderful achievement of the Washington navel at the New Orleans Exposition, and with some remorse told how squarely Riverside had met the citrus world and conquered it with the famous orange from Brazil. A few days after the publication of my tribute in a Los Angeles paper, a letter was received from your best known citizen commending my zeal, but disputing my facts. "Why, it was not the Washington navel at all that took the great prize at New Orleans, although it was exhibited under that name," so the letter ran. "When the call for oranges to enter the competition came from our committee the Washington navels were all gone and we sent over a lot of Australian navels instead." The exposition committee had forgotten to mention this fact, and the Riverside Washington navel has been accredited with the victory until this day. Had I known this fact, my respect for the fruit exhibitors of Riverside would have been greatly enhanced.

But these bits of historical sauce will not pass for the solid food that ought to be set before this Convention. Before introducing the topic to which most of this address will be devoted, a few words of appreciation may properly be spoken of this community. The State of California owes more than compliments to the people of Riverside. The fruit growers of Riverside are of the highest type of successful business men, and no more expert or enterprising horticulturists than our hosts are to be found in the world. So great has been the progress of this people that nothing we could say in praise of them would add to their fame as fruit growers. No matter how warmly we might commend the achievements of this section, however, it would neither stimulate local vanity nor engender outside jealousy, for the conquest of the desert here has been that of the honest pioneer, and has been so helpful to other portions of the State that there is no place for envy. The self-complacency of Riverside twenty years ago was a challenge; now it is understood, and it is a charm. It is not blandishment to tell her people that they have earned such distinctive honors in horticulture, and bear them with credit and profit to the State as well as tactfully to their own distinction.

But we can best show our appreciation here of what Riverside has done for horticulture, by making this Convention of substantial value to the industries so well represented on the programme of this meeting.

To make the office of State Commissioner of Horticulture worthy of support, it should be devoted more largely to the initiation and execution of policies that should command the attention and respect of the State. It should reflect the best judgment of the fruit growers and carry out their will wherever possible, and without injury to the welfare of others, to unite, advance and protect the fruit interests for the common good of California. Indeed, this office should forfeit the confidence of the taxpayers should it be content with the performance of mere routine duties or clerical work. No executive office can fill its measure of usefulness without understanding the needs and the aspirations of its constituents, and I wish, during my incumbency, to recognize this principle by taking the fruit growers of the State into full partnership, both individually and in their conventional capacity. To secure this coöperation, we must have more personal acquaintanceship and closer individual touch. Especially should our conventions

devote more time to conference upon the administrative measures of the Commission, to the relation between its work and that of the county horticultural offices and to the improvement of the laws governing the officials delegated to conserve the interests of fruit growing. Since my experience at the last Convention I am sure that the present meeting will recognize the Commissioner's address as a legitimate means of promoting this unity of purpose and efficiency throughout the State.

However well we may understand the needs, establish policies and provide laws governing your State Commission, they can not be properly executed through the meager appropriation now received. Do you know that only one cent out of every 400 paid in State taxes is appropriated to the business of maintaining the office, patrolling and quarantining the State against pests, fighting invasions of insects, holding these conventions, and publishing information for the fruit growers? That is exactly what the fruit industry is getting—one penny out of every $4 paid into the State treasury. And that is not all. The State, with commendable economy, requires us to give back 24,000 of these pennies every year for office rent in a State building from which we must maintain continual watchfulness to protect the commonwealth herself from the invasion of fruit enemies and plant diseases. But it is not of record that any one, either fruit grower or his representative officials, has ever made a serious effort to get more than this one fourth of one per cent with which to guard and promote one of the heaviest taxpaying industries in the State. It is difficult to account for this inertia on the part of the otherwise most enterprising and successful body of fruit growers on the face of the earth; or to explain why the horticultural leaders and officials have not adopted broader policies, and worked for the means of carrying them out. And thus we should not blame our legislators for overlooking a giant industry that has no insistence or coherence in securing recognition from the public funds—an industry that has enriched all California from the consumers' purses of the East as no other has; an industry that has directly and indirectly brought hundreds of millions of capital for investment, and established tens of thousands of families; an industry which in 1906 acknowledges 315,000 acres of vines and 32,700,000 fruit trees, besides the number to which the attention of the assessor may not have been called. Therefore it is not in criticism or complaint that we should consider this deficiency of support, but with good will and assistance to all other landed industries and their kindred, provision should be made in the future for the proper support of your chief office, therewith to protect and promote your industry and give it added security as a heritage to your children.

I am devoting this paper largely to personal conference with the members of this Convention. For the privilege of meeting you I am paying car fare from Sacramento and return and the living expenses here this week from my private funds, and must continue to do this wherever my duty calls for the next sixty days. After the first of July I will again for another year get one penny for traveling expenses from every 14,200 paid into the State treasury, as the law provides that these traveling expenses must be paid from our fund of $500 per annum given for this purpose to your Commissioner's office. Again, the Constitution forbids the Commissioner from accepting a pass or even

accepting reduction in ticket rates, although the railroads would willingly grant either, in recognition of the benefit my office might be in extending their fruit traffic. The fruit growers have not been told these plain facts at their conventions before and I know they will enjoy it, especially when I tell them in this Convention that I do not regret having to pay my own way here to represent them officially, for it is worth all the cost to again meet the people of the city where my great citrus fruit triumph occurred twenty years ago. But it requires money to go about over the State trying to adjust the difficulties of the county commissioners, and pull together the coöperation and efficiency contemplated by the law. Since last Convention week I have traveled from Yreka to National City, from Siskiyou to San Diego, as the orators put it. These visitations were made in conference with the supervisors and horticultural commissioners regarding their relations and the support of the latter's work. In an intervening county a new issue was met. The supervisors in session stated that their grain farmers and stockmen were complaining about the few hundred dollars the county had appropriated toward the protection of orchards and stamping out the greatest peril with which the State has yet been threatened. The complainants were not getting their share of the county appropriations. Let us see what grounds they had for this idea. However, in presenting the following figures it is foreign to my purpose to criticise a coördinate department for securing large appropriations, and we should approve here without reservation the full support of every institution that may advance the welfare of those who get their living from the soil—a position that should be taken by every patriotic citizen of the State.

For the fiscal years 1907 to 1909, the State Agricultural Society secured for maintenance and buildings $87,500, and for the State Fair $5,000 and the gate receipts. The Dairy Bureau was given $11,000. For cereal improvement $10,000 was appropriated, and for tobacco culture $1,000. These items foot up $114,600 appropriated by the last Legislature almost exclusively for the advancement of the interests of the grain and stockmen. For the same fiscal years the State Horticultural Commission was given $35,000 for support and $12,000 for the Insectary building and parasitic research. There was certainly no discrimination here in favor of the orchardists, for these figures show that the farm and stock industries were granted more than three dollars for every dollar appropriated to the promotion and protection of fruit growing. Neither were other landed industries nor the outdoor sporting interests neglected, for the same Legislature voted $51,000 for the use of the State Mining Bureau and $87,500 for the Fish Commission. Summing up these items we find $253,100 were voted to the field, mining, and inland fish interests, as against the $47,000 devoted to the work the State Commission of Horticulture is expected to do in the promotion and protection of an industry which has done more for the State than any other enterprise. We should sit in admiration at the feet of these interests, and while applauding their success in securing funds, learn of them how all things come to those who do not wait.

In the foregoing account no State funds appropriated to agricultural education and investigation have been included. In the University and California Polytechnic appropriations, it is impossible to segregate what portions may be used for the different branches of agriculture, and

this is not necessary, for the mere presentation of the list will show that farming, stock raising, and dairying have not been treated unfairly. During the three last years the University has received $282,000 for the Davisville Farm. The stockmen were the prime movers in getting the $150,000 in 1905 with which to purchase the land. In 1907 the Legislature added $132,000 to the farm fund, the appropriation bill providing that this fund shall be used "for the purpose of equipping and furnishing the dairy building and livestock pavilion; the erection and equipment of a dormitory building, the construction of cottages, livestock barns and buildings, of greenhouses and propagating houses for horticultural and viticultural purposes, the purchase of livestock, dairy and farm machinery." The great educational work here provided for is not partial to the fruit grower, for the livestock and dairy buildings alone will absorb the greater part of this appropriation. The University has given wide attention to the interests of farming and vegetable growing through its regular faculty work; and in the laboratory at Whittier field crops are receiving about as much attention as fruit trees. Of the $164,500 appropriated in 1907 to the California Polytechnic School the policy toward farming was as liberal as the provisions made for the work of the University. The Polytechnic School received $12,000 for building a creamery and $15,000 for the purchase of additional farm land. There can be no question but that the University College of Agriculture and the Polytechnic School will be impartial in the way they will conduct their educational and experimental work, but from the very nature of the work the equipment and support of their course must largely favor the farm and stock interests. Nor has the General Government been less attentive to the interests in question, for the agricultural bill just passed at Washington carried an appropriation of $11,500,000, and the largest single appropriation for agricultural purposes on record was that of $250,000 for investigating the cotton boll weevil. And the fruit growers pay their proportion of these great expenditures.

In this discussion I have not alluded in detail to the expenditures of the Federal, State and county governments for the advancement of agriculture. Immense sums have been spent here in forestry work and protection, in soil and drainage, surveying, and kindred activities. But it requires an equal amount of money per acre to determine the character of grain land as compared with fruit land; reforestation and fire protection are alike valuable to fruit culture, grazing, lumbering and grain growing; reclamation, drainage, and levee protection cost the same for all classes of land, and national irrigation, even if applied entirely to fruit culture, is not paid for by a property tax. Those interests which complain of county expenditures for orchard protection should remember that no assessment is made on farm crops, except alfalfa, and that every vineyard over three years old and every orchard over four pay tribute to the county as well as the State fund in addition to the assessed value of the land on which the orchard or vineyard may grow. It requires no argument to show that the fruit growers should receive protection from the State and county funds that will in some measure make up for this special tax which is levied on their property every year.

I hope this subject is of such vital interest to you that it will not

tax your patience to pursue it further. But this subject is paramount to all others you may consider at this Convention, unless it be that of the proper legal equipment of the State and county horticultural officers, and this matter is to be considered by a special committee appointed at this meeting. From the field assessment notes of fourteen counties of the State, and embracing fifty fruit-growing districts, the average assessed value of orchard trees is $50.50 per acre, and the average assessed value of the land bearing these trees is $140 per acre. The best orange land in Orange County is assessed at $310 per acre including the trees. Covina reports show some assessments as high as $500 an acre for land and groves. San Bernardino County has land standing at $375, and $125 for the trees. The highest assessment of fruit land in Santa Clara County is $560 for land and orchard. But I have taken the highest and lowest and all intervening values in these fifty localities from the fruit-growing districts north and south, and the average assessment for land and trees is $190.50 per acre. An equal number of farming land reports shows the average assessed value to be $31.20, and grazing lands average $7.60. From this showing it appears that bearing trees make the taxpaying duties of the land six times as great per acre when compared with that of farms, and twenty-five times as great when compared with stock land. But some one may say: "Look at the immense value of these lands to the owners. An orange grower at Riverside could sell his grove for $2,000 an acre and walk away with the money. What would the public get out of that transaction?" I would answer that the grove still remains. Of the $12,000,000 assessed valuation of this county, it is safe to say that $6,000,000 lies within cannon shot of this hall. The town lots and their improvements are assessed at about one third that of the acreage and its improvements. Hence, the business and professional men of Riverside are doing business on practically a $6,000,000 capital with an investment of only $2,000,000. Rough figuring, you say, but it is smooth enough no doubt to slide far below the realities, for no one can estimate the business value, the residential value, or the future value altogether that accrues from the turning of a wilderness into a garden; the value of the tourists who come here to see what the fruit-growers' activities have actually created here in taxpaying wealth and homelike beauties. And so it is in a hundred horticultural districts throughout the State. Can you say this of the other landed interests, some of which cover whole townships without a home? With the exception of a few shipping and trade centers, and a few health and summer resorts, every live city or town in the State is in the midst of a fruit district, as no other industry approaches horticulture in the work of building up other industries of the State.

Then why should not the orchardists require more adequate protection for their fruit trees and vines? There are over 40,000,000 fruit trees growing in the State at this time and 315,000 acres of vines. If the growers were allowed but one cent for every five of these orchard trees, to say nothing of the vines, it would provide an annual fund of $80,000 with which to guard our boundaries from further invasion, stamp out perils already established, unify the work of quarantine and control throughout the State, and equip the office of the State Com-

missioner with the machinery for doing the work intended, and which no other department can do.

This address has now gone to the limit of the time and perhaps of your patience. There are many topics of great importance that have not been reached at all, but I believe one subject considered in detail is worth a dozen merely brought to your attention. I have presented the subject of the proper equipment of this office, and without prejudice or resentment toward any other interest that may have been more fortunate in receiving support from the State. You will notice that I have not boasted of what the office has done since I took charge last October. There is too much time given to telling of one's achievements, and it is so easy to magnify one's work and make believe things have been accomplished that have only been attempted. But we have been busy all the time, and yet I hope these meetings will find occasion to inquire more minutely into the policies and work attempted by my office, and try to find out if your Commissioner is doing his duty. There is simply no limit to the field in which this office could make itself useful and yet not encroach upon the duties of any other department. This body of fruit growers is able to secure the means of making my administration more effective, and if you give the matters herein set forth your most earnest attention it will be but a short time that we will have to skimp and economize and even borrow money with which to fight the greatest peril of the fruit industry.

MR. JAMES MILLS. I think one of the most important matters that this Convention may consider, or can consider, is this address so ably made. It contains information that every grower who shall attend this Convention should be in possession of; and I believe, Mr. Chairman, that the discussion of this address should be deferred until the largest number of growers who can attend here at this Convention are present. I move you, therefore, that the address be referred to a special committee of three, to be appointed by the Chair, for their consideration, and for the placing of it before the Convention at a later date.

Motion seconded, put, and carried.

PRESIDENT JEFFREY. Would you like to make suggestions, Mr. Mills, about the committee?

MR. MILLS. I would suggest that Mr. J. H. Reed be chairman of that committee.

PRESIDENT JEFFREY. That is very acceptable to the Chair, and I am sure it is to the house. Mr. Reed will be the chairman of that committee. I have not been able to find out who are here yet, and I will appoint the balance of the committee this afternoon.

Now, if there is nothing of a business nature to bring up at this time, we have Dr. Jordan with us, and I am sure you will all be pleased to hear Dr. Jordan. (Applause.)

ADDRESS OF DR. DAVID STARR JORDAN.

Ladies and Gentlemen, Members of the Fruit-Growers' Association: I have no particular message. I have been here presiding over an Indian conference. I don't know very much about Indians, but being chief of a tribe of savages, I was well fitted for any such work as presiding over the conference.

But I am very deeply interested in the fruit-growers' work, the fruit-growers' convention—very deeply interested in this tremendous industry which is as yet in its very beginning.

I was thinking awhile ago that primitive man was in very much the same condition as the primitive bear that Charles W. Warner speaks of. He was out gathering blackberries at one time, and he saw a bear coming along. The bear was gathering blackberries. He took them in both hands and ate all the green ones and ripe ones together, had not any thought of selecting the ripe ones; and Mr. Warner abandoned his pail of blackberries to the bear, who was very much gratified to find that the good ones had all been selected, so he didn't have to eat the green ones and the prickles.

Primitive man went into the woods and took what he could find, ate his blackberries green and ripe the same as the bear does. He used in those days to live in hollow trees or caves. By and by he learned the trick of making trees hollow. By and by he learned the trick of splitting trees up and making them into hollow houses, and he learned a good many tricks afterwards besides those I have just mentioned. He learned the same way in regard to fruit. He learned after awhile there were places where there was good fruit and places where there was not; he would go and camp out where the good fruit was, just as a primitive man used to go and camp by the bays where clams were to be found; and in many places you will find great mounds or hills of clam shells, the result of these visits of primitive man. Then it occurred to primitive man that he could take the clams and place them in other places, so he could have fresh clams to eat whenever he wanted them.

In the same way, he learned where the good fruit was and good blackberries were; that he could take the seeds and plant them wherever he pleased, and so have his own berries; and that he could dig up roots and plant them wherever he pleased and so have them wherever he liked. So he began to gather around his house these wild fruits of various kinds. By and by he found that some bushes had better fruits than others. Then he began to select out his seeds from the best berries and things of that kind, and in the same way about the same time he learned that with many fruits he could take one of the buds off of one tree and put it on another and so get a better grade of fruit.

And so this work of selecting wild fruit went on unconsciously and finally consciously, and within the last generation men have learned the fine art of developing fruits and making fruits. It is just as easy to improve on the wild fruits as it is to improve on the hollow trees and make houses by splitting up the trees and fastening the pieces together. With these wild fruits enormous improvements have been made—unconsciously at first.

In the first days when the Roman writers speak of the apple and pear, they had no idea of the Bartlett pear or the Baldwin apple, or any of the better apples grown in late years. They had a pear in mind that was not over an inch in diameter and of sweet juice, and sweet flesh there was very little of it. They had only little pears and little apples. They hadn't anything such as we know of the apple or pear. They speak of the grape. The grapes were farther along than many other things. Finally we come to the fine art by which a man takes two different kinds of fruit, or what he wants, that is, two pears for instance, or two plums that have good qualities, and crosses this one with the other, thereby getting something new, getting a mixture of the qualities of one and the qualities of another. Then, in the next generation, he has all kinds of mixtures, and out of these mixtures he selects anything he wants. If there are certain good qualities that one pear has, and other good qualities that another has, he can select out of those the things that he wants.

The work of Mr. Burbank is in the absolute infancy of such work. It is going to be as possible to improve on the fruits of to-day as to improve on the huts of our ancestors when they got out of the hollow tree business. We are to continue in enormous developments in that line. It was said by Summerville that one had only to chalk out on the wall the kind of house he wanted and he could build to that end. It is possible to chalk out on the wall the kind of pear, plum, cherry, wheat, or anything else we want, and by selecting, by the fine art Mr. Burbank has carried farther than any one else, produce it. Many men are learning to do this, because there is no secret about it: it is simply crossing and the selection of what you want, and having the skill to know what you want, and the patience to wait for what you are working for along those lines, everything will come in time.

I should like to live a few hundred years from now in order to pass through the month of August and see what kind of fruits people are going to have in California in those days, for this country is most favored of all in regard to the production of these high fruits; and they are going to be developed higher than we now conceive of.

It is a simple thing to prepare almost anything. If one wants to make sugar out of turnips, it would be easy to get a sweeter turnip than usual out of which to make it. It was an open question at one time whether we would make sugar out of beets or parsnips, because both had sugar in them and we could make it out of either one. It would be perfectly possible, if we should lose every fruit tree we have, every orange and every plum, every pear, every apple, everything, to go out into the woods of Siberia and Japan and North America and Europe and take wild fruits and bring them right up again in a few generations to the fruits that we now have, or to even better fruits, by the processes that we know of now connected with horticulture.

I am not telling you anything new. I come here simply to show my good will. I have been invited many times to address the Convention, but always for the last few years I have had something else on hand. I can't always get away; I am not my own master: I am the servant of a great many people. But it is a great pleasure to me this morning to come here and just say good morning; and I hope

you have found the fruits in Riverside all that you have expected. (Applause.)

PRESIDENT JEFFREY. We will now listen to a statement from the Secretary, Mr. John Isaac.

Secretary Isaac stated in his report that, as secretary of the Thirty-third Convention, he had been instructed to forward resolutions, then passed, favoring a national horticultural quarantine and the parcels post, to the representatives of California in Congress and to other United States officials interested therein. That in compliance with such instructions he had sent copies of the resolutions, and received acknowledgments from those to whom they were sent. These letters of acknowledgment, which were of a favorable trend, were read by him, and on motion, the report was adopted.

(At this time an adjournment was taken until 1:30 o'clock P. M.)

AFTERNOON SESSION—FIRST DAY.

Tuesday, April 28, 1908.

PRESIDENT JEFFREY. You will please come to order. It now affords me great pleasure to introduce Mr. J. B. Neff. Mr. Neff is a conductor of farmers' institutes for the University of California, and lives at Anaheim. He will now read a paper on "Walnut Culture and Top-Grafting to Increase Production."

WALNUT CULTURE AND TOP-GRAFTING.

By MR. J. B. NEFF, of Anaheim.

When walnuts are spoken of in California it is always understood that softshell walnuts are meant, and softshell walnuts are becoming known in the markets of the United States as "California walnuts," this being the mark of excellence and used to distinguish them from imported walnuts. These were formerly known as English walnuts, probably because of having been marketed by English merchants when all walnuts were imported, but likely originated in Persia or Asia Minor, though it has been found native over a wide area, including the mountains of Greece, or Armenia, of Afghanistan and the northwest Himalayas. It is also found in Japan, and has been reported as growing on the highlands of the Congo, in central Africa. Walnuts from Persia were brought to Rome by merchants, and from there the trees were distributed over Europe and to America.

There are no records to show when the first walnut trees were planted in California, but the best authorities say that it was about the year 1769, and that the planting was done by the Mission fathers. Very few trees were planted after this first planting for nearly one hundred years. About the year 1843 a few trees were planted at San Diego by

J. J. Warner, and in 1848 F. E. Kellogg, Sr., planted a small orchard at Calistoga, in the upper part of Napa Valley. J. R. Congdon planted an orchard at Capistrano in 1869. H. K. Snow and P. T. Adams planted the first walnut grove in the vicinity of Tustin and Santa Ana in 1879. The planting was an orchard of eight acres, which was characterized as a rash adventure by the neighbors, but the soundness of their judgment is shown by the fact that the orchard is one of the best producers in the valley after more than one third of a century has passed. These early plantings were all of hardshells. A few years later some additional acreage was planted by Snow and Adams until 15 acres were in one plot. The trees were planted too closely, and ten years ago they began to take out alternate trees. The orchard has been abundantly fertilized lately with stable manure, and the production last year was 25,800 pounds.

The softshell walnut originated in Santa Barbara County, on the farm of Joseph Sexton, and came into notice in 1880. It is supposed to have been the result of cross-pollination between hardshell and papershell walnuts, but is more likely to have been a seedling of the hardshell, showing one of the many changes that may be expected of seedlings. Softshell walnuts soon became popular and have been planted exclusively for the past twenty years under the name of Santa Barbara softshells, but this term does not mean any particular variety and includes all seedling softshell walnuts generally found in the market.

There are but few walnut groves of commercial importance north of Santa Barbara County, though there are some small orchards in the Sacramento Valley and several small areas in Santa Clara County and near Santa Rosa. The walnut trees of the northern part of the State are mostly of the French varieties, and largely of Franquette, as it has proven the most productive in that district, though not equally successful in the southern counties.

Large plantings of grafted and budded walnuts have been made in the southern counties within the last ten years, and almost the entire planting of the northern counties are grafted trees. The variety mostly propagated in the south is known as the Placentia Perfection, and originated in the Placentia district of Orange County about eighteen years ago. This is a vigorous, upright growing tree, which produces large smooth nuts that hull freely and are well filled with white meat, but while it gives better returns, both in price and production, than the average seedling softshell it will sometimes lose half its crop by blight.

The stocks used for grafting and budding have been largely seedlings softshell in the south, while that used in the north has been mostly native black walnut, and very frequently these are not grafted until ten to fifteen years old.

Walnuts should be planted only on good, deep soil, not underlaid by hardpan, nor where the water will stand on the surface. A deep, sandy loam is to be preferred, but walnuts will do well on the heavy soils that are free from alkali. Good drainage is always necessary, as well as freedom from late frosts and a comparative cool climate. The greater part of the orchard planting has been 40 feet apart. This is too close on good land and better results can be had by planting 50 feet apart, while 60 feet is not too far in some cases. The planting is generally done with the object of getting a large number of trees to the acre instead of get-

ting the maximum production of walnuts from the tree, and increasing its length of life. An orchard may be made to pay a good income early in its life by planting 50 feet apart in squares, with a tree in the center of each square which can be taken out after twelve to fifteen years. In this way the profit from the interset trees will often be enough to pay for planting and land by the time they will have to be taken out. It is necessary to have water for irrigation in most places, as the walnut tree needs more water than it usually gets. Walnut trees do not require the heavy pruning that is needed by most deciduous fruit trees. The lower limbs should start four or five feet from the ground, and in such a way as to have the heavy side of the tree to the southwest. A good rule for the early pruning is to cut off only those branches in the way of the team when cultivating, or that will draw the tree too much to the northeast or away from the prevailing winds. When the trees are eight to ten years old there will be small branches in the center that shut out the sunshine, which should be taken out, together with all branches that are crossed. There will be no walnuts in the center of the tree unless there is some sunshine through the tree. A good deal of labor and time can be saved if the trees are gone over in June and the long and useless shoots taken off. It may also be necessary to go over them again in July, but the work at that time will be light. The young trees should be supported by stakes for the first two or three years. A convenient stake is made by using redwood 2 x 2 x 9 feet long. This makes a stake long enough to use for support for branches that may be drooping, and these branches may be trained in the proper direction by using short lengths of light baling rope to give the branch the proper angle.

A walnut orchard that has been well cared for will begin to bear paying crops after the fifth year from planting and should increase in production for many years. Walnut trees will live to a great age in suitable localities and with proper care. Trees in the south of France and in Spain that are believed to be more than 300 years old bear regular and heavy crops.

A blight of both nuts and green twigs began to attract attention about nine years ago; the Department of Agriculture at once instituted investigations, which were supplemented and are now being carried on by the University of California, but the idea of finding a remedy for the blight has been to a great extent abandoned and attention turned toward solving the problem by finding trees that are resistant to the blight to such a degree that they will produce paying crops under the same conditions which cause other trees adjoining them to lose the greater part of their crop. A series of investigations have been made with a view of getting a tree that will be resistant to a great degree, and at the same time produce large crops of desirable walnuts, from which to propagate by grafting or budding. The investigations give much hope, as several such trees have been found, and with the added interest that is taken some very excellent trees are likely to be found.

Grafting old walnut trees in order to form a top of some more desirable variety than the original has long been practiced in a small way in California, but has been confined mostly to black walnut stocks. Almost every other variety of fruit tree has been top-grafted, some of them several times on the same tree, but there has always been a hesitancy about cutting off a walnut tree that was not paying, the common belief being

that the work could not be done successfully. That this is without foundation is shown by the many trees in various parts of the State, notably Santa Clara Valley, the vicinity of Vacaville, the vicinity of Santa Rosa and others, where roadside trees and small orchards have been worked over at various times, running back as far as 1893 at Vacaville and 1891 at San José. Some of these trees now have a spread of branches of 60 feet.

The average seedling walnut orchard is not satisfactory for several reasons; the nuts are uneven in size and form, the trees are not equally productive, and are largely subject to blight. It may be said that about one quarter the trees produce but few walnuts, another quarter produce about enough to pay their own expenses, leaving the other half to make whatever profit is obtained. This will be entirely changed when the entire orchard is of grafted trees, grown from scions that came from resistant trees that produce large crops. Each tree will then produce nuts like every other tree, and if the selection of nursery stock has been properly done, the trees will be very uniform in all respects.

Several styles of grafting have been practiced and all have had a fair degree of success, but modifications of the cleft graft have been most generally used, each operator making changes as he thought best. If the trees are from three to five inches in diameter they may be cut off at about four feet above the ground and below the branches, then four or five scions may be placed in one stock, or three or four of the branches may be cut back to within 10 to 24 inches of the trunk and two or three scions placed in each. All the other branches should be removed from the trunk. Old trees of from twelve to twenty years should have the branches cut at places where they are from three to six inches in diameter and from five to eight stubs left, which will be from three to six feet in length, and should have as many as six scions in the large stubs, the other branches being removed before the scions are put in place.

The method used in my orchard near Anaheim, which was very successful, is as follows: just before the nuts were ready to gather last fall the orchard was gone over, the trees that were non-producers and those that did not produce paying crops, as well as those producing small or badly shaped nuts, were marked so they could be distinguished later. The object in marking was to do the grafting on trees that were of no commercial value, and to keep up the production of walnuts to an amount equal to that of other years. Having determined the trees to be grafted, the operator marks the stubs that are to be left by a small notch out of the bark at the place where the cut is to be made. All other branches are cut close to the trunk of the tree. Several trees are marked while the assistant is preparing the first tree. The operator places the scions, and the assistant follows with hot wax, covering all cuts on both scion and stock. In cutting large branches it is necessary to make two cuts, the first being some distance outside the final cut, to prevent splitting the stub or the trunk. The scions should always be of solid, mature wood, that is, with as small pith as can be had readily, and must have good living buds. They should be about one quarter inch in diameter and have at least two buds. The growth having buds close together is best, as shorter scions can be used which do not require so

much moisture as the longer scions, and consequently are more likely to grow.

When the tree is prepared use a heavy knife and mallet to split the stubs, placing the knife across the stub as if a chip one half to five eighths of an inch thick was to be taken off. Then depress the handle of the knife to an angle of 30 to 45 degrees and split the edge down to 2½ to 3 inches, allowing the knife to reach the farther side of the stub, but not making the split entirely across the stub. Open the cleft with an iron wedge one half to five eighths of an inch wide and thickest on one edge, placing the thickest edge toward the outside. Trim the cleft in the stub with a sharp knife so it will be smooth. Then cut the scion so as to fit perfectly and place it so as the inner bark (the cambium layer) of both will be on the same line, or at least will cross twice, then remove the wedge and put hot wax over all the cuts on both stock and scion at once. It is as necessary that the scion should fit the cleft on the inside as it is to fit along the cambium layer, and also necessary that the cleft be filled with wax near the scion. The work should be examined every three or four days until leaves are found, and if threadlike cracks are found near the scions they should be closed with hot wax so the scion will not be exposed to the air when the tree begins to grow. Any cuts on the body not waxed should have a coat of heavy mineral paint, and the body and stubs a coat of whitewash.

The wax is made of 1 pound beeswax, 5 pounds rosin, 1 pint flaxseed oil and 1 ounce lampblack, melted together. The object is to get a wax that is soft enough to be pliable without running, and a little practice will soon show whether the wax needs more or less oil. A convenient furnace can be made for heating the wax in the orchard by taking a coal oil can, cutting out the top, placing four wires across, two each way, about four inches from the top, and cutting an opening to use in placing fuel in the bottom. A wire bail completes the furnace. A three-quart saucepan is large enough to hold wax, which may be made as needed. A good operator will place 300 scions per day, and about 25 scions are needed in each tree to insure a stand, it being better to have more than is needed rather than too few.

If there is an excessive flow of sap it should be wiped off the stub at every examination of the scions and the stub covered with wax as soon as dry. Any excessive flow of sap for several weeks will cause the loss of the scions, as the callus can not form in water. This may be controlled by boring one-quarter inch holes in the body of the tree near the ground. Care is needed that too many holes are not made. Three or four holes four inches deep will be sufficient to control the flow of the largest trees. No damage is done to the body of the tree, as the holes soon callus over.

After the scions have made one-foot growth it will be necessary to nail laths, 1 inch by 2 inches by 8 feet, Oregon pine, on the tree in such a manner that the shoots can be tied to them and the new tree formed as desired. Leave the laths on two years.

Do not take off any of the sprouts at first except such as may be very close to the scions, but as the scions grow some of the sprouts may be taken off. When the sprouts grow to two feet long they should be headed back, but not removed until the following winter. Keep all the

scions that will grow the first year, and never head back the growth from a scion while it is in a growing condition. If more scions have grown than are needed, they can be thinned out the next winter, and if some scions should fail so as to leave a stub without growing scions a sprout may be trained and budded the following August or September, or may be grafted the following spring.

Trees that are fifteen years old when top-grafted may reasonably be expected to have a spread of 30 feet in four years and to be in full bearing. It is not at all unreasonable to expect an orchard to average 150 pounds to the tree, and trees that are 50 feet apart should produce an average of 200 pounds when well fertilized and well cultivated. Grafting may be done at any time within six weeks of the time the buds will open, and the scions may be cut as needed. Heavy fertilization will produce larger crops, even where blight is serious, and by this means production can be increased until the orchard may be gradually changed to the more resistant varieties. The most economical method, and at the same time the best, is to grow green manure crops and supplement with acid phosphate, or superphosphate, as commonly known. Buy acid phosphate that will run 18 to 20 per cent available phosphoric acid and sow broadcast 10 to 15 pounds per tree at the time the green crop is sowed, or it can be sowed just before plowing at any time, the object being to get the phosphate as deep as possible in the ground.

Walnut orchards have not had the care that has been given to oranges, neither in selection of varieties nor in culture and fertilization of the soil. It is possible that the blight may cause growers to use better methods of culture as well as selection of varieties, and in the end be the means of largely increasing the production and value of walnut groves. The largest annual production of walnuts was 8,000 tons, but with increased planting this has fallen off until the production is only 6,500 to 7,500 tons per year. Individual trees that produce 200 pounds per year are not uncommon, so it can readily be seen that if only the best trees are used for propagating, the yield of walnut orchards can be greatly increased without much additional expense and the profits be correspondingly greater.

It is very probable that seedling walnuts will become as scarce as seedling oranges are at present. In fact, there is no good reason why they should not be entirely replaced by the better grafted varieties. The markets demand the best in other fruits, and the seedling walnuts will eventually be left without friends.

PRESIDENT JEFFREY. We are now ready for discussion of Mr. Neff's paper by a young man who has had a great deal of experience along certain lines in efforts to better the resistant qualities of our walnut trees. As you are aware, some of our old walnut sections are nearly out of the race. The trees are there, but the blight is bad, and it has been the duty of Professor Ramsey to try to find some better resistant varieties, and he is here now and will come to the platform and tell you what his experience has been. Professor Ramsey of the Southern California Pathological Laboratory.

PROFESSOR RAMSEY'S ADDRESS.

Ladies and Gentlemen: Your honorable Chairman here asked me to prepare a paper also on the walnut industry and the top-grafting of the walnuts. A very short time ago I was down to see Mr. Neff and saw the paper which he had prepared, and saw that he had very fully covered the ground which I shall cover at this time; and as I was out in the field nearly all the time since then, I decided that I would simply try and discuss and emphasize some of the points which he made here this afternoon, and also probably go a little more fully into the nature of the walnut blight, about which you have all heard more or less, and try, probably, to correct to some extent the impression that has gone abroad that this walnut blight has really put most of the old seedling walnut orchards in a very bad condition. That is, that it is a blight which is seriously threatening to do away with the whole industry.

There is a good deal of truth in that, but the walnut industry I feel sure is going to come out of it all right. It is not in quite as serious a condition as the pear blight industry in the north, though it does resemble that to some extent in this respect, that the disease which afflicts the pear is a bacterial disease. This walnut disease is also a bacterial disease, but we have this difference: the pear blight endangers not only the crop of the pear tree, but the vitality of the trees, of the orchard, and of the industry itself. The walnut blight, while it does cut down materially the crop in the walnut orchard and in the whole walnut section of Southern California, does not materially decrease the vitality of the tree.

To some of you who may be unfamiliar with the situation and with the workings of the walnut blight, I will say this, that most of the dead branches which you see in the tops of the old seedling walnut orchards at present are not a result directly, I should almost say indirectly, of walnut blight. That is primarily a result of climatic and soil conditions which are rather peculiar some years, and which differ a good deal. The old seedling walnut is very susceptible to changing climatic and soil conditions. If you should have certain periods of cold weather, followed again by warm weather, there is very liable to result a serious die-back of the walnut. In fact, most of the dead twigs which you find scattered through a lot of the old walnut orchards at present in Southern California, even in some of the larger walnut sections, are due primarily to sudden changes in climate, or to some change in the moisture conditions in the soil, or else to indifferent or no care at all.

I will say this in reference to the walnut situation this year, that the conditions have been very favorable thus far this spring for the setting of a good crop, and if the weather conditions continue as they have during the past three or four weeks, the prospects are that Southern California will have one of the largest walnut crops in its history. But this does not mean at all that we are getting past this period of disease; that this disease is dying out in any measure at all. I want to try to explain to you briefly how this disease is primarily dependent upon climatic conditions.

As I said before, this walnut blight is a bacterial disease, caused by a minute organism so small that you can place from twenty to twenty-

five thousand of the little fellows side by side and you would only have a string one inch long. It is not their great size which does the injury at all, but their great number. The loss is primarily due to the first infection, which occurs in the spring about this time, or a little earlier, when the small walnuts which are just formed, are from one quarter to one third of an inch in diameter. These little walnuts commence to blacken at the end. There, where the moisture is the greatest, where the succulency of the tissue is also the greatest, where it is the tenderest, and where it gives the best foothold for the blight, there at the blossom end you nearly invariably see the blight starting; and in most cases these walnuts will fall off before the loss is noticed, and after they have remained on the ground for two or three days, they have dried up, and the orchardist, if he has not observed very closely, will simply say that the walnuts did not set very well. While it is a fact that most of the loss occurs at that time, you can see the ravages of the blight throughout the whole season. When the walnuts become larger, the infection, in addition to taking place at the blossom end, may occur at certain points or most any point on the walnut itself; and if the walnut has not reached sufficient size, in most cases these infections will continue through the hull and into the shell and into the meat of the walnut, and then, of course, that particular walnut is of no more value from a commercial standpoint. The ravages of the walnuts are noticed principally at the gathering time in the fall, when there will be all these hulls which will be found to be empty of meat; that is, the blight has eaten out the meat entirely.

Now, the blight does infect the young twigs to some extent, and the shoots of the walnuts, the small leaves sometimes an inch long, sometimes two or three inches long; but in very few cases does it kill the twig entirely. The blight is carried over from year to year, principally through these old leaves which occur in these young twigs, and again perhaps in the old decayed and infected walnuts which are found on the ground. There is a saying that there is nothing really so bad but what there is some good in it after all; and while the walnut blight has very materially cut down the production of walnuts in this State, and in the southern part of the State particularly, it has, I am safe in saying, hastened the time when we are going to have grafted instead of seedling orchards. The industry itself is in a stage of transition from the unscientific seedling era of the past to the more scientific and stable period of the future, when you are going to have the walnut orchards composed entirely of grafted trees, of varieties which are good producers and more or less resistant to blight.

This proposition of getting resistant or immune varieties for the control of walnut blight is not simply a dream of the future, but is an actual reality. We have to-day at least half a dozen varieties, which, if the orchards of Southern California were composed of grafted trees from these varieties, would, I am safe in saying, materially increase the production of the walnuts in Southern California, while also extending its range of culture. We have varieties that, while they are not good producers, produce walnuts of good, desirable shape, walnuts of good size, with white meat and well filled. We have these varieties that are at the same time almost immune to this disease.

There has been some work done by orchardists in the past to try to

perpetuate these desirable varieties by planting walnuts from these particularly desirable trees. However, if they had taken scions from these trees instead of planting walnuts from them, and grafted them on to some desirable stock, they would have perpetuated in nearly every detail all of the desirable characteristics which they wish to perpetuate in their new orchard; whereas in planting seedling walnuts from these old trees, they were simply getting another seedling orchard, which would in very few respects be superior or even equal to the old orchard.

There may be a possibility that out of one hundred walnuts planted from some desirable tree there would be five or six trees which would be equal to the parent tree; probably two or three which would in some respects be better; whereas ninety-five per cent of the trees would in all probability be inferior to the one from which the walnuts were procured. That is the experience in planting seedling walnuts, as much as in planting any other seedling fruits. However, there is this to commend the planting of seedling walnuts, and that is, the planting of seedlings with the idea of selecting some certain tree or strain which may suit his particular purpose. The best tree in an orchard is largely a personal equation. The owner himself may have picked out a certain tree which in all respects suits his tastes; whereas if some other man had owned that orchard he might pick on some other tree. Of course, productiveness is not to be disputed. They would probably all pick on certain trees for productiveness; but there is that element of personal equation which always enters into the selection of what is best, because our idea of what is best is not always the same.

Now then, briefly, all other methods of blight control have been found to be a failure. The idea of spraying a walnut tree with either Bordeaux mixture or some chemical or other has been abandoned by the station entirely. We tried it out pretty thoroughly when we first took up the investigation of the walnut blight. We tried out a whole lot of different chemicals, tried it at different times, and tried it on a scale large enough which ought to show something at least as to its efficacy in controlling the blight; but in no case of all the chemicals which we used, applied at different times and in different places, did we find any good result whatever.

Then, again, the great size of walnut trees, the time and money required to spray them, would have to procure a saving which would be decidedly large in order to make it a paying proposition at all. And then, besides, there is this element: After you have sprayed this year, if you want a crop again the next year, you would have to do it all over again. Then the idea of inoculating a tree with some kind of chemical by boring holes into the trunk of the tree has been exploited largely both in pear and walnut blight, principally by unscrupulous persons, who were after the money more than the results; and even all the scientific experiments which I know of which have been made along that line fail to show a single instance where this method of control of any bacterial or fungous disease has been of any practical value at all. They seem to fail to comprehend the situation. They do not seem to understand that anything put into the trunk of the tree will not enter into the circulation of a tree exactly as it will in the human system. Any of the chemicals which may be introduced into the tree, no matter what it may be, if it gets into the ascending sap, will be carried up into

the sap, and there all of the inorganic food materials which can be utilized for food in that tree will be transferred into organic material; whereas the poisonous product will be left more or less as a residue, and if enough of it accumulates will ultimately prove injurious to the tree.

There is, however, another method which I think will materially help to bridge over this gap between the going out of the seedling orchard and the coming in of the grafted orchard, and that is the proposition of proper fertilization, irrigation, and cultivation. There is no doubt that in nearly all the old seedling orchards which we have to-day in Southern California, if they were properly, intelligently and carefully fertilized, irrigated, and cultivated, the production could be materially increased to the profit of the one who is the owner or the recipient of that orchard. By a number of experiments which we have made in coöperation with experiments which have been made by growers individually, it has been conclusively demonstrated that the production of an orchard can be very materially increased by the use of fertilizers rich in nitrogen and phosphoric acid, by intelligent and careful cultivation the season through, so as to conserve moisture, and also by a late fall and winter irrigation. Orchards which have had good dressings of barnyard manure, followed by heavy applications of fertilizers rich in both nitrogen and phosphoric acid, have within the last three or four years, some of them, almost doubled the yield. The idea of irrigating late in the fall is simply this, that in that way we can escape largely the ravages, or, rather, we can escape some of the effects that usually result in a seedling orchard from sudden changes in climatic conditions. By keeping the trees growing as late as we possibly can in the fall, the trees will come out later in the spring and escape that worst period of infection which occurs in the spring about two weeks or so earlier than at the present time.

So, then, Mr. Neff has covered pretty well the proposition of grafting over an old orchard by the selection of non-producing trees in an orchard, and gradually working these over. If, at the same time, we will supplement this top-grafting of the orchard by intelligent fertilization, cultivation, and irrigation, we can keep up the production of most of the orchards to what it is at the present day, and at the end of five or six years have most of the orchards grafted over into varieties that will not only be desirable from the standpoint of productiveness, but also desirable from the standpoint of quality and every other characteristic that you may require in a walnut. He has explained to you pretty well the method which he has used down there at his place; and I want just briefly to mention another which we have used in our experimental work this spring at the Whittier Station, and the work of course being carried on at various places through the walnut-growing sections of Southern California. The method which Mr. Neff used, as he told you, was a variation of the cleft method. For the sake of variety, and of trying out various methods, we used a modification of the whip-graft method, which has been used very successfully by Mr. Weinshank of Whittier, especially in nursery grafting. This year I looked over much of the nursery grafting which he did this past spring. Only yesterday, and by actual count, we found that the per cent which he has growing at present varies from eighty-five to ninety. As a nursery graft I think that is, perhaps, the best method which we have at the present

day. It is a modification of the regular whip-graft which we use in apples, and is made simply by cutting the scion across and making another cut right straight down with the grain in the scion. Then, instead of cutting the stock completely across like the scion, we just simply make a little cut on the side. We don't cut into the pith of the wood at all. Then, just simply place the two together in that form, tie them over with a string, and then wax them over. That, on young trees, or at least on stock of this size, has proved to be the best kind of a graft that I know of. It has at least proved to be very successful the last three or four years, at least in nursery grafting. This year we tried this same method on larger trees, performed exactly in the same way, only that the lip of course on the larger limbs, which are three or four inches through, would be considerably larger, and the scion instead of being placed directly in the middle of the lip, or in the center, would be placed on the side so as to have the cambium of the scion connecting with the cambium on the stock at least on one side.

I examined within the last two or three days all of the trees which we had grafted over that way, and found that while there are not one hundred per cent of the grafts growing, there are enough of the grafts growing to make a top on every one of the trees. We would put in from three to four, or sometimes five scions on a large limb, and in most cases there are growing three or four scions on each limb at the present time, with every indication that they will keep on growing and make good limbs. After tying these up, after the scion has reached a certain stage of growth, this string will commence to bind. After it has reached, say three or four inches growth, take a knife and cut down right there where the scion is. Just cut the string in two. Of course that is all waxed over, and the wax on either side will still tend to hold the string, and as the wood gradually grows, the strings will gradually draw apart, and it will not bind it as it would if the string was not cut. Of course if you would leave the string on there, the string would eventually cut the scion in two, and then the scion would die.

In the northern part of this State, and in Oregon and Washington, they are growing principally the French varieties, the Franquette or the Mayette. While those varieties may do equally as well with us down here, we have varieties which will probably do a great deal better, which up there would not do very well, because they get out earlier and would be liable to frost. So this proposition of different varieties will have to resolve itself into the adaptation of certain varieties to certain localities as suits those particular climatic conditions.

The problem of walnut blight control for the future rests quite largely with the nurserymen, and of course with all the other individuals working in coöperation with the nurserymen, and with the station, too, in the selection of blight resistant trees, and then in the honest propagation from varieties which are known to be good; and while we have not found an absolute remedy for the blight, no spray of any kind which is going to save the walnuts from this dread walnut blight, I am, in a measure, glad that no such thing has been found, because it would be, at the most, simply a temporary measure. This idea of getting resistant varieties, which is not simply an idea or a dream of the future, but a reality to-day, is not going to be a thing of temporary value, but a permanent benefit to the whole walnut industry of the State. It is

going to help place the walnut industry on as stable a basis as is the citrus industry to-day, and I look forward to the day when we shall have orchards of grafted varieties where there will be an average production in the orchard of at least 100 pounds to the tree. To-day, in a seedling walnut orchard, it varies all the way from 5 pounds to a few exceptional trees with 100 pounds. Perhaps the average would be between 40 and 50 pounds.

Eliminating, then, the proposition of blight altogether, is it not reasonable to suppose that by proper and judicious selection we could get grafted varieties which would produce, even though they did blight to some extent, walnuts to the extent of 100 pounds or more to the tree. We have to-day blight resistant walnuts which are producing desirable walnuts of 200 pounds to the tree. I do not think the walnut industry is a thing of the past, or that it has seen its best days, but I think that the walnut industry is just coming into its own, and that the time will come in a few years when the walnut industry will be on a more stable foundation than ever, and that the output, instead of decreasing from year to year, will continue to increase until it will outstrip all known previous production.

The President next introduced O. E. Bremner, of the Quarantine Division of the State Horticultural Commission, who presented a paper upon the grape industry, as follows:

THE PRESENT AND FUTURE STATUS OF OUR GRAPE INDUSTRY.

By O. E. BREMNER, of Sonoma County.

If the predictions of the pessimistic experts of grape culture, uttered some five years ago, as to the conditions at that time, and what was to happen in the near future, had been correct, we would find our grape growers in about the same dilemma that to-day confronts the pear orchardist; but a prosperity marking the degree of their error, and by this contrast showing to the highest advantage the present status of the industry, in spite of phylloxera, Anaheim, and all the other diseases that grapes are heir to, has placed us beyond the vagaries of the past to a position well nigh impregnable, and California has to-day a greater acreage of grapes than ever before, and there will be planted this year more vines than in any year previously.

The ultimate success of our grape industry must be attributed to the spirit which pervaded the men, who, having faith in our California soil and climatic conditions, were willing to risk something in experimenting. It may be, by introducing the new varieties of grapes from Europe, we also brought in the phylloxera and other less disastrous diseases; yet the same men who sought most earnestly to establish these European varieties were just as persistent in working out the problem of resistancy. And although we are profiting by their mistakes, other mistakes are being made and will continue to be made. Still we feel that the future of the industry is assured, if the prospective planters will not repeat these experiments, but using the facts now before them, plant quality and quality only. This is the one point and sole theme of

my argument, and if I can just make you see it as I feel you ought, I believe that the last and perhaps greatest menace to our industry would be removed.

In Europe, after the phylloxera had ravaged their wonderful vineyards, and they had found that as large if not larger crops could be produced on their resistant vines, they immediately sought to increase their output by sacrificing those forces which formerly gave them quality for those that produce quantity. And what is the result? The Italian papers just recently came out with an appeal for the people to drink more wine so as to reduce the glut on the market. And why this glut? This wine is quick aging, some or much of it old at eighteen months, and is not fit for bottling, and there is too much of it to attempt to blend with their fine bottling wines. Northern Africa is developing into an immense wine-producing country, but of this same low quality. So, if Europe is suffering from an overproduction of low-grade wines, what can we, with our limited market for such a product, expect by following in her wake? This same principle holds good, in a measure, for everything the land produces here in California, but the result is not so manifest in an almond tree producing only one crop in five years, as in a grape producing an abundance of an unmarketable product annually.

First, we are to consider whether our conditions will warrant the planting of vines, then the variety and the method. I saw a query in one of our horticultural papers the other day, the substance of which was, "What variety of vines shall I plant on a low, damp piece of land subject to frost?" How could any one expect to raise any kind of grapes under such conditions? Why try to raise grapes on land adapted to water cress or late garden truck? We necessarily look to our market as the criterion of our variety. The table grape shipper, wine maker and raisin packer will readily inform us as to the quality expected, and we can not discriminate between a Zinfandel, with a low or a high percentage of sugar, and a Tokay poorly colored or badly packed. I know of no other rule or law completely covering these vital points. The individual conditions must be looked into. There are, however, some fundamental facts that we all know or should know, and as there is, just now, so much indiscriminate wine-grape planting, it might be well to look at a case.

The Zinfandel is a first class dry wine grape in every respect, yet to produce the ideal wine certain conditions must be adhered to. We know that this grape does not ripen evenly if not on proper soil and under proper conditions, or the quality of the grapes may vary widely. For instance, in a place that I have in mind, the hillside produces a medium sized bunch of firm, sweet, highly flavored grapes, with tough skins, very little affected by mildew or even a rain. About a hundred yards away, in a rich silted flat, the vines produce enormously with excessive foliage, large compact bunches of large grapes with thin skins, lacking in sugar, very subject to mildew, and totally spoiled by a light rain.

Now, in pruning these vines, we must consider the quality of our crop, and the conditions under which it is grown. If you prune severely, leaving few spurs and buds, you will get a large growth and a big second crop, a condition, therefore, advisable where you have

frosts that may destroy your first crop, as you will then have a second crop to partially make up this loss. If, on the other hand, you want all first crop, you should leave more spurs and buds and your growth will be shorter, and therefore little second crop. Zinfandels seem to do best on bottom land, pruned trellis system, and contrary to the European conditions, a vine pruned high will mature as early as a low one, so no uneasiness need be felt about pruning high when the conditions warrant it. If you wish to produce only first class wine, Zinfandels should be planted only where they will produce a sugar test of at least twenty, and not over twenty-four, as a Zinfandel at twenty-two produces wine with eleven and one half per cent alcohol, which is ideal. I have merely used this grape as a type, the same relative conditions applying to the others, for when they are too low, or exceed the sugar limit, or are lacking in the finer qualities, they depreciate themselves just so much.

As to some of the other standard varieties, the Caragnan is a good grape, ripening a little later, a heavy bearer, but not quite so fine a variety. The Petite Syrah is the grape of the future. A grape fulfilling all demands as to bearing, quality, etc., with but perhaps one drawback, a very difficult vine to prune, but experiments now under way will, I believe, solve this problem the coming season. I might also mention the comparatively new Grannoir as a grape of quality. I must say, however, that the Bouschets are poor, and the planting of these should be discouraged; the wine drops color badly and is no better than third class. For blending, the Burger is a great bearer, but has a tendency to be sour and can not be universally recommended, as can the Chasselas.

There is very little use to quote varieties in raisin or table grape culture, but with these latter the same characteristics pervade as to localized conditions. With the resistants there seems to be still much to learn. We can, however, profit by what has already been done and can, at least, begin where the French have left off, and thus prevent largely what would probably be useless experimentation. The French have settled on the bench-grafted vine as the best, and for good reasons, the principal drawback now being the lack of affinities. For instance, the Zinfandel seems to be one of the worst, and takes poorly to all of the resistants; the best results attained so far being a Champain graft on Rupestris St. George. The shoulder graft, used by the French growers, gives fairly good results. There is little need of saying that vines on resistant roots produce just as good quality and a little larger crop, on the average, than on their own roots.

In planting rooted vines your general conditions should be carefully taken into consideration, that you may have the best results. For instance, in deep, warm soil with plenty of moisture, where you get a large growth, it is best to cut the roots back to at least one and a half inches; in dry, lighter soils, six inches or more should be left. You will readily see that this resolves itself into a rule which will, I believe, fit most cases: Prune your roots in inverse proportion to the growth produced by your soil conditions. If the growth of a vine is equal above and below ground, what will happen when we plant a vine with a large root system and cut the top back to two buds? If you have plenty of moisture, and your ground is fertile, you will get a large root

system that will take up more water than can be thrown off by the leaves. A check of sap issues which, I believe, is the prime cause of black root knot. In other words, there can be no return flow, and this unassimilated sap must escape, and we therefore find the root knot breaking out at the weakest point of our vine. In many of our sections, where vines are now being planted in warm, deep, gravelly loam, I prefer cuttings to rooted vines if properly taken and planted. The cuttings should be eighteen inches long, with the bottom cut squarely across, just below the bud, one quarter of an inch below the diaphragm. The relative position of this partition can be more easily judged if you split a few canes and observe carefully its relationship to the bud. Never cut slanting through the bud, as is sometimes recommended, for you will destroy the bottom node and the roots will be found straggling all the way up the cane, instead of a whorl at the bottom node. The top cut should be slanting, one half to one inch above the bud. The cutting should be planted with just one bud above the surface of the ground. I believe by this method you will get a vineyard with root systems natural to the conditions and very less apt to suffer from root knot. You eliminate to a minimum the danger of introducing diseases or insect pests. You are sure of the quality and variety of parent stock, and the cost is enough reduced to be an object.

It is an old adage, but as applicable to-day as ever, that you should not carry all your eggs in one basket. The raisin and table grape growers are not absolutely compelled to dispose of their grapes in one particular channel. But with the dry wine grape grower it is different. Their grapes would not make good raisins even if their locations would permit of drying. They are not acceptable as a table product, so it is just wine, wine, wine, and at this day when we are all going dry, as far as alcoholic beverages are concerned, many who have locations admirably adapted to this variety of grape culture feel some uneasiness, if not panic, over the future prospects of our wine industry. As I have said before, there is and always will be a demand for the best, but I feel that there is bound to be corresponding glut of the inferior wines if the present ratio of planting is indulged in. Is there, then, any way out of the difficulty? I think there is, and that the problem will be at least partially solved by the establishment of the unfermented or sweet juice industry. Now, it may be that we are to go through the same stages in establishing this product that we have passed in our wine, raisin, or, perhaps, as a better example, our olive oil products.

The Eastern States have created a good and steadily increasing market for sweet juice, which they produce entirely from American vines, and which is consequently endowed with their particular flavor. Whether it is advisable to continue along these lines by planting their best varieties in the locations most favorably adapted in this State or, acting independently, produce from our European varieties a sweet juice of a different flavor, is perhaps the key to the situation. As for me, I am for the production of a California juice as distinctive as is our olive oil, and I am as firmly convinced that its success will be much more rapid and complete than has been the production of this oil, which we all hold superior to the imported product.

There are those who contend for the Eastern varieties, and their

arguments are good at least as to the particular flavor, their hardiness as shown by their resistancy to phylloxera, their value as a table product, etc. On the other hand, we run some risk of importing new pests if we introduce their vines. We have troubles of our own now, for, what with contending with phylloxera, hoppers, Anaheim disease, etc., we have no desire for a closer acquaintance with their grape root worm (*Fidia viticida,* Walsh), the grape cane borer (*Amphicerus bicaudatus,* Say), the grape berry moth (*Polychrosis viteana,* Clemens), or the black rot (*Laestadia bidwellii,* Sac.). We also import a vine adapted to only a restricted portion of our State and one which has no other uses than the aforesaid limited sale as a table product. By the production of a high grade juice from our European vines, we will create another channel into which any excess of production could be turned; we will create a market for another strictly California product, and the fact that it is distinctly Californian, will assure its acceptance by the consumers who have already learned the value of a California fruit product. We will assume no liability in planting vines that we do not already know the productive value of, and that could not be turned to other purposes, should there by any delay in establishing the industry.

In New York, which produces a greater amount of sweet juice than any other State, a full crop is estimated at from two to three tons per acre, these grapes selling for from $30 to $40 a ton. They are, of course, handled with much more care than we are wont to give our wine grapes. But considering this extra cost, compare it with our California vineyards, producing from four to eight tons to the acre and for which we would be glad to be guaranteed from $15 to $20 a ton. It might be that the handling of these grapes for sweet juice would be a valuable lesson to the wine men. For it is essential in the production of must to eliminate all foreign elements, and to this end the greatest care must be exercised from the picking until the juice comes out in its sterilized bottled form. Just the opposite methods are apt to prevail to a great extent in the handling of wine grapes. From the first slam into the picking box, which after a few trips to the winery is soaked with juice and reeking with dust and refuse, to the chute they are subjected to the roughest kind of handling.

The sweet juice industry has already been started in California, and I learn that there is a growing demand for our product. Both red and white juices are being produced from some of our highest flavored European vines of the Muscat type. Cabernet and Mondeuse, are being successfully used, and there has been suggested by one of the best authorities in the State the Petite Syrah, to which I have called your attention particularly as being probably the most desirable of all dry wine grapes, and now on this suggestion recommended as one of the best, if not the best, for the production of red juice. Of the Eastern varieties used, the Concord is practically the grape. Others include such grapes as Catawba, Early Moore, Delaware, Ives, and Isabella. If such grapes are to be planted, I would particularly recommend a comparatively new grape, the King, a Concord seedling, which is probably a better grape than the Concord. The Brighton and Banner are also good grapes. As to location and cultivation, they require well drained, preferably sandy soil, with a moister climate than our interior

valleys afford. They would, therefore, be better adapted to our coast counties. In the East they are generally grown on a two-wire trellis.

The method of producing the juice is a sterilizing process, which neither eliminates nor changes, but merely concentrates the elements of the grapes, and thus we have a product, not only pleasing to the taste but of a high nutriment value as food. It is not only used as a drink, but forms the basis for many pleasing and nutritious foods. It is also used extensively as a nourishing beverage in the sick room, for invalids and convalescents, as it is a wonderful system builder, containing about one fifth grape sugar, one of the most easily assimilated forms of food. The elimination of the fermentation and fortifying processes used in the production of wines leaves it absolutely non-alcoholic.

There is always danger in exploiting a new industry that you will be carried away with your project and may strand some zealous follower high on the shoals of a barren market. But with this subject, if I have made my meaning as clear to you as I have intended, that we are not to explore a new field, but are merely establishing a new channel for our California grapes which may tend to reduce the current of our mighty river of wines and may eventually establish itself on a foundation just as broad and firm as any of our similar industries. As our present success can be directly attributed to the careful selection, care and indomitable energy of the past, so will the future depend on the degree to which we exercise these same actuating principles.

PRESIDENT JEFFREY. The discussion is now open, and I will be pleased to have Mr. Roeding come forward to the platform. He is not unknown to most of you, but I take pleasure in introducing to you Mr. George C. Roeding.

MR. GEO. C. ROEDING. I have prepared no address, and it seems to me it would be far better if I might be permitted to answer questions rather than to attempt to discuss matters. In doing so I might touch on many matters which would not be of interest. I would feel far easier if questions were asked for me to answer, and if I can not answer them I will call on others in the audience who are more familiar with the subject than I am. I think we can get more information in that way than by my attempting to make an address.

PROF. A. J. COOK. We have a three-thousand-acre vineyard near here that is very badly affected with flea-beetle. I would like to ask you what is the best remedy for that disease?

MR. ROEDING. I know very little about that, and I think I will have to refer that question to Mr. Carnes or Mr. Bremner. They are entomologists, and I am not.

MR. BREMNER. It is a pretty tough proposition. I have not had a great deal of experience with it. Very little can be done for it. I would advocate the use of hand picking, that is, jarring them off, but that is not very successful. Then you can use a spray—any arsenical spray. Paris green may do some good, but particularly I would advise arsenate of lead.

PRESIDENT JEFFREY. There seems to be no positive way to handle it, and if any one has any answer further than Mr. Bremner has given, we would like to have it; if not, I would like to ask Mr. Roeding a question about the main feature of Mr. Bremner's address, and I believe you all would like to hear Mr. Roeding's opinion on that. There is a general interest on the question of the fruit juices. Carloads come to Los Angeles every year from the Welch Fruit Juice Company of New York and other manufactories. Portland takes an equal amount. San Francisco perhaps in the future, but not now, will take a similar amount. California is not producing any of that juice. Rochester, out here in your county, or near your county, is producing some fruit juice. I would like to hear from Mr. Roeding as to that phase of the grape industry.

MR. ROEDING. I want to say to begin with that I know practically very little about the wine business. I know this much, however, that our larger vineyardists, or rather, the larger wine makers, notably among them the California Wine Association, and the other large manufacturers of wine, are taking quite a deep interest in the manufacture of grape juices. From the present tone of the people, not only in this State, but in other states in the Union, it looks very much indeed as if wine drinking, that is, wines that have alcohol in them, will not be carried on to the extent that the makers would like to have it. (Applause.) And it becomes necessary for our wine men to look into the necessity of a makeshift, and probably that makeshift will be the grape juices. I know that to a limited extent the wine men of Fresno County and the San Joaquin Valley have been making experiments in the manufacture of grape juices; and although they are not entirely satisfied with the results of their work, nevertheless the experiments which they have made thus far have given them sufficient incentive so that it is quite possible they will be successful in making the grape juice out of the common type of grapes that are grown in California. It is a well-known fact that such varieties as the Concord, that have been used for making these juices in the East, have not been planted to any extent in California, although there is no doubt that these varieties will grow. But before they will come into bearing, unless our wine makers can find some other grape which will answer the same purpose, the wine business will be in a very deplorable condition. You are no doubt aware that the wine makers of California have spent more in the development of their cellars, in their cooperage, and the other paraphernalia which goes to make up a cellar, than probably any other industry handling any of our fruit products. No one, unless he has visited some of the immense wine cellars in the San Joaquin Valley and other parts of the State, has any realization of the amount of money which these men have expended in the development of this industry; and of course to cut it off without anything else, not only jeopardizes their business, but jeopardizes the business of every man who is raising wine grapes.

PRESIDENT JEFFREY. I would like to make one statement. There is a woman at Pomona who established the business of making fruit juices. Some of you know that lady. She has established a fruit

juice business that is so profitable to her that she wouldn't sell it at any price. Mr. S. H. Taft is here, and I am sure you will all be glad to hear from him on this subject.

MR. S. H. TAFT. I have a grape which is known as the California Concord. Eight years ago I found this grape, and found it different and superior in my judgment to anything that I had tried. I learned that it was sent down from the north with six or eight Isabellas. I investigated to see if this was true and found that it was. This vine had very much larger leaves and a more vigorous stock than the Isabella, and the fruit was somewhat larger—not so very much, but larger. I tried to buy the vine, but could not; and I got some of the cuttings, and from those cuttings I commenced to develop the vines, so that for a few years past I have been selling them wholesale and retail. I will say in regard to the leaf that it is very large. You will find some of them in the Chamber of Commerce. I took some there that measured 14 inches across; I took some there later that measured 18 inches across. It is utterly immune to this disease that has swept the grapes all over the country. There is never a sign of it. Its vigor seems to give it entire protection. I call it the California Concord.

PRESIDENT JEFFREY. Mr. Taft, who is our guest to-day, is one of our oldest citizens, and this grape that he is telling about has measured 18 inches in diameter in the leaves, and the grapes are nearly as large as olives. It has exactly the flavor of the Concord. It is grown at Santa Monica and is very free from disease. Whether it would be a good commercial variety or not, we don't know. If Mr. Taft has got a grape which will succeed anywhere and everywhere, we will all be very glad to know it. Mr. Taft does not claim to have created this variety, but he claims to have developed it and brought it out. It is a remarkable grape in itself. Whether it will be a good variety to plant or not, we don't know.

MR. JAMES MILLS. Mr. Roeding, what demand is there for a table grape? To what production can the table grape be increased in this southern country and yet give a favorable return on the capital invested?

MR. ROEDING. As I said, I have given most of my time to the nursery business. But bear in mind that there is another large interest outside of the wine industry in this State, and that not only pertains to the table grape, but to the raisin grape as well. You must have some realization of the development of the raisin grape business when I tell you that the production last year was between sixty and seventy thousand tons in this State. The table grapes shipped, if I remember correctly—I am subject to correction in this—amounted to something like 8,000 carloads last year. With these facts before you, it is not necessary to believe that the industry of grape growing in this State is going into the ground because the wine business is not in the position that it was a few years ago. There has been a very extensive planting of raisin grapes—more during the past season than of table

grapes. I know of my own knowledge that in Fresno County alone there were at least five million Muscat vines sold by nurserymen there, mostly planted in Fresno County and some of the adjoining counties—not many of the adjoining counties because of their restrictive ordinances, from which I am a sufferer, I am sorry to say; but these ordinances have not prevented the very extensive planting of Muscat grapes and other varieties in Fresno County and in other counties of the State.

It must be borne in mind that although planting is very heavy all these vines don't grow. There is always a large percentage of vines that fail to start; and this, with another fact, that many of the older vineyards are gradually going to decay, either from old age or the ravages of the phylloxera, evens up the production when these younger vines come in bearing. I am of the opinion that it is a mistake for one man to do just exactly what his neighbor is doing. Nevertheless, that seems to be the tendency of the people in a great many cases. If Muscat grapes happen to bring a very big price in one year, the tendency of all those who intend to engage in the growing of grapes inclines to the planting of that one variety of grape, regardless of whether their soil is adapted to it or not. This is a mistake that a great many planters make. Because a certain variety of grapes has brought a large figure, the tendency is to plant that in preference to anything else. It would be far better if those who intend to plant grapes would plant the varieties best adapted to their soil conditions.

There are a great many other varieties of grapes which are profitable and have been profitable in this State outside of the Muscat; and the table grape business, in my opinion, has a great future. The varieties which people have planted, as a rule, are the Malaga, Flame Tokay, Emperor, and Black Hamburg. I am of the opinion that the Flame Tokay is not adapted to San Joaquin Valley conditions; and even in this locality, where the climatic and soil conditions are very much like they are in the San Joaquin Valley, I don't think it would be advisable to plant the Flame Tokay—not because it does not bear well, but largely because it does not color well. There has been a very extensive planting of the Malaga and Thompson Seedless in the Imperial Valley, and probably a limited planting in this section. There is no doubt that the latter variety has a great future as a shipping grape up to a certain time. There was a car of seedless grapes shipped out of Fresno County last year that sold for a higher price than any carload of grapes ever sold in the United States before. This carload of grapes brought $3,600, if I remember right, in New York, which is the heaviest return ever received for grapes. It is a very promising kind for shipping purposes, but of course must be shipped early in order to be profitable.

This grape is followed by the Malaga, which is a very large white grape. Most of you know of its firmness, thickness of skin, and other qualities, it has always carried well; and unless the market is glutted by too many carloads in any one city, it has brought a good price. The latest grape that we have in Fresno that has been planted to any extent is the Emperor. This is very similar to the Tokay, but ripens fully a month later. Most of the shipping commences toward the first of October, and continues up to the first of November, and even later than that. There is also another grape which has been extensively

planted, and that is the Black Cornichon. It is very similar in shape to the Emperor, ripens a little earlier, and is a heavy producer. It has even a thicker skin than any of the other varieties of grapes, and for this reason has always shipped well.

There are other varieties which I might mention, namely, the Black Morocco and the Gros Colman. Both of these varieties ripen later than the Emperor or any other variety I have mentioned, but they are little known; and the only reason I can understand why they are not planted more extensively has been, as some of the fruit men have told me, because the demand has never been as heavy in the Eastern market for black grapes as it has for red. Otherwise there is no reason in the world why such varieties as the Black Morocco and the Gros Colman have not been planted extensively. They are very good producers and ripen fully two weeks later than the Emperor.

There are two new varieties, one called the Dattier de Beyrouth, also known as the Risington. I predict a very great future for this grape. It is sometimes on the form of the Malaga, only much larger, and has the remarkable faculty of ripening almost at the same time as the Thompson Seedless. It is a beautiful amber color, and in that respect is far better than the Malaga. Another variety, which will probably be extensively planted when it is better known, is the Sultanina Rosa. That is the same as the Thompson Seedless. The true name is Sultanina Rosa, not Thompson Seedless. That is a misnomer. The Sultanina Rosa is identical with the Thompson Seedless, except instead of being white it is pink, and it is a striking grape to be packed with the Thompson Seedless.

The Dattier de Beyrouth comes from Asia Minor, and it is also grown in Smyrna.

PRESIDENT JEFFREY. I will say that the people of Lodi and vicinity are literally riding in automobiles on the profits of their grapes, and I don't see why you should not add that to your other industries here.

Now, we are going to have another lively time from now until a quarter past four. Mr. S. A. Pease will read a paper on "Parasites and the State Insectary."

PARASITES AND THE STATE INSECTARY.

By S. A. PEASE, of San Bernardino.

The present status of parasitism means the value of the different parasites, local and introduced, as proven by their efficiency or lack of efficiency in the orchard or elsewhere to-day. California has had a lively interest in parasites for our insect pests ever since the introduction of the *Vedalia cardinalis*, parasite for the white scale (*Icerya purchasi*), in 1888. At the time of its introduction, the white scale threatened the citrus industry of California. Thousands of dollars had been spent in mechanical methods endeavoring to subdue the pest, but with very poor results. The *Vedalia* proved master of the situation, and in fifteen months from the time of its introduction had practically cleared the field and given the orchardists renewed courage. Later,

another parasite, *Novius koebelei*, was liberated in the orchards and proved a good second for the *Vedalia*. Since that time growers have hoped that equally good parasites would be discovered and brought to our State to combat all of our insect foes. These hopes have been crowned with varying degrees of success and failure.

Probably the San José scale (*Aspidiotus perniciosus*) was next in importance to the white scale, as its presence and injury was widespread and fatal to the deciduous fruit industry in many localities. Great expense was incurred in combating this scale with salt, lime and sulphur, kerosene emulsion, and other remedies for a good many years. Persistent efforts were made to find the natural enemy of the scale, and the effort was finally crowned with success. The San José scale is kept in a satisfactory state of subjection by parasites—the *Aphelinus fuscipennis*, *Rhizobius lophantae*, *Chilocorus bivulnerus*, and others.

A perfect parasite in one locality is not necessarily a perfect parasite for the same scale in another locality. As an illustration, note the trouble they are having with the San José scale in the Eastern States, notwithstanding the efforts that have been made to introduce the parasites there. The climate or other conditions seem to prevent the perfect work that prevails here. This fact should teach us not to be too hasty in declaring that we have a parasite for other scale pests as soon as a supposed new parasite has been introduced into our State. Every new parasite, no matter what its record or reported record in some other country has been, must necessarily be tried out here and should be given its just due and no more. We have too often had our hopes raised by premature reports of perfect parasites being introduced that after trial proved of no avail.

The apricot scale, *Eulecanium armeniacum*, has never to my knowledge been known south of the Tehachapi, but north of that has been a serious pest. It is, however, now controlled by its parasite, *Comys fusca*, which, like the parasite of the San José scale, lays its eggs beneath the scale, these eggs hatching in the proper season into larvæ which eat out the scale inside of its shell or house, pupates there, and later the perfect fly emerges through a hole which it makes in the outer covering of the scale.

The soft brown scale (*Coccus hesperidum*) is also kept in perfect check by its natural enemies, chalcid flies and others.

Aspidiotus hederae, *A. camelliae repax*, which are common feeders upon oleander, English ivy, umbrella, privet, pittosporum, and other varieties of plants, and which are sometimes found on the orange and lemon, and then called lemon peel scale, are quite well controlled by chalcid flies, *Rhizobiids*, and *Chilocorus bivulnerus*.

Since 1893 we have had periodical reports that a perfect parasite had been introduced that would keep in perfect check widespread pest and life destroyer of fruit and other trees—the black scale (*Saisettia oleae*). It was about this time that *Rhizobius ventralis* and *R. debilis* and *R. toowoombae* or *lophantae* were acquired. Those, with the aid of *Tomocera californica* and *Chrysopa californica*, did some splendid work along the coast. Indeed, they made such a good showing that orchardists in the interior had great hopes that they would control the scale everywhere. Hundreds of thousands of them were colonized in every section of the southern orchards; but after repeated trials

and after waiting a number of years for them to be acclimated to our drier and hotter interior climate we were forced to give them up and again resort to fumigation and spraying to relieve the orchards.

In October of 1901 our hopes were again raised by the report that a new parasite had been discovered in South Africa, and that a lot of oleander cuttings were on the way to our State Commission. The cuttings arrived and the little fly was bred out—the *Scutellista cyanea*—and after a little time colonies were liberated in Los Angeles County and later were distributed from there over all Southern California. They increased so rapidly that it was commonly thought that finally we had the right enemy for the black scale, and that the pest was doomed. In two years' time I saw in our own county orchards where at least 60 per cent of the black scale was parasitized in the month of August, and I, with the rest, thought that our troubles with the black scale were at an end. The following April I looked for a colony, but could not find one. The same results had to be recorded for May. In June I could find a very few, as also in July. In the latter part of August they were very numerous again, but I looked farther this time and I found that while in some instances 60 per cent of the old scale was parasitized, still from 75 to 90 per cent of the young scale had hatched and was out on the leaves and limbs of the trees. After close study of the situation for a year or two I arrived at the following conclusion: The *Scutellista* is an egg eater only, and as the black scale in the interior counties are practically all hatched out by the first of September of each year and do not commence laying eggs again until near the first of May, the *Scutellista* starve out between September 1st and May 1st. I have, however, seen some good work done by the *Scutellista* along the coast. In Ventura and Santa Barbara counties, within one or two miles of the ocean, the olive trees are the cleanest that I have ever seen, and this result was accomplished by the *Scutellista;* but on one place I saw that the olive trees were green, while just across a driveway the lemons were quite badly affected with the black scale. This desirable condition along the coast may be, I think, attributed to the fact that the black scale have in some places more than one brood a year, and that *Lecanium hemisphaericum*, which is very plentiful there, breeds in the same way, and thus more of the *Scutellista* are carried over the winter and are ready to work on the first eggs produced by either the black or hemispherical scales in the spring. At the present time the State Commission is trying to establish a body parasite for this pest, and we continue to hope that the efforts in this line will finally be rewarded with success.

The yellow scale (*Chrysomphalus aoinidum citrinus*) was first known as the San Gabriel red scale on account of its lighter shade of color. In fact, until very recently it was considered by the Department of Agriculture as a variation of the red scale. Its habits, however, are different, as the red scale infests the leaf, limb and fruit, while the yellow is seldom seen on the limb, but only on the leaf and fruit. For years this scale has been credited with having a parasite that would check it to the extent that it would no longer injure the orchards. Individually, I have had occasion to look up this scale very closely. It was introduced into a part of our county not infested with any other scale, so that it could not be confounded with others. It was reported

to the State Board, and Alexander Craw, then with the State Commission, determined the species and sent colonies of *Aspidiotophagus citrinus*, the supposed parasite. These were reinforced many times, and after thorough inspection I can say I never saw one tenth of one per cent of the scale that were parasitized, and I so reported to the State Commission. I was told that it was very queer, when they did so well elsewhere. Later I had opportunity to observe this scale elsewhere with the following results: I found the scale very bad everywhere that artificial means were not taken to control it. I once had several hundred leaves sent me from Los Angeles County so that I might breed out this parasite. These leaves were thickly covered on both sides with the scale (not a good indication of parasitic work), and I put them into breeding jars and cared for them for a month, but not a single parasite did I get. During a trip to the northern part of this State I looked up the parasite there, and found very little, if any, evidence of their work, but there was plenty of yellow scale everywhere. I found them in the Capitol grounds at Sacramento and on trees at Marysville, Yuba City, and Oroville. So, I was forced to the conclusion that the *Aspidiotophagus citrinus* was not to be relied on. The reputed parasite is a golden chalcid fly, whose method is like that of the *Scutellista*, *i. e.*, wherever it works you will find the small round hole in the scale where it makes its exit.

Somewhere about the year 1891 or '92 Albert Koebele, who had been sent abroad by the State Board of Horticulture, sent among other parasites a steel-blue ladybird (*Orchus chalybeus*), to prey upon the red scale, and these ladybirds were liberated in the Kerchival orchard in Los Angeles, but after much time the decision was arrived at that they were not equal to the task. They are still to be seen occasionally in the coast counties, but not in sufficient numbers to do much good.

For a number of years we have been told that one of the *Rhizobiids* was preying upon the purple scale, viz., *R. lophantae*, but I venture to assert that a person untrained in this line would need to be told that they were working. Later, the State Commission of Horticulture received a new parasite for the red and purple scales and sent experts to breed them in the worst infested orchards, but after a lapse of considerable time they appear to diminish in numbers rather than multiply, and we can place nothing to their credit.

Mealy bugs (*Pseudococcus citri*) bid fair to be a most serious trouble. They have a number of enemies, one of them *Cryptolaemus montrouzieri*, but their control of the insect is only partial, and so not satisfactory.

The introduced parasite for the widespread enemy of the apple grower, the codling moth, *Carpocapsa pomonella*, is *Caliephialtes messor*. It works well in confinement when supplied with larvæ or cocoons of the moth, but after a number of years' trial in the orchards has no friends to sound its praises.

The cutworms, *Agrotis saucia* and *Peridroma saucia*, are periodical enemies and general feeders. The moths lay the eggs, and later the cutworms emerge. These dark colored moths may be seen flying in the twilight over the flowers and elsewhere. They usually lay their eggs in March, and the worms appear in April. We are troubled with them, sometimes once in two years, and sometimes only once in four years.

There are two common enemies of this pest, one a large black beetle (*Colosoma angularis*), which feeds upon the worms in both larvæ and beetle stages. The other enemy is a Tachina fly (*Froutina frenchii*), which lays its eggs in the worm as it crawls; the eggs hatch out later when the worms are in the pupæ stage, and the maggots eat out the pupæ, and in turn pupates and comes out the fly again. I have known as high as 90 per cent of the worms to be parasitized in this manner, so that in the breeding jars I would get that percentage of the flies instead of the moths.

Our common feeders, the *Chrysopa californica* and *Chilocorus bivulnerus*, and others feed upon the mites and plant lice to quite an extent. Plant lice also have an enemy in the footless maggot, which devours them in large quantities.

To sum the question up, it will be seen by the foregoing that we have successful parasites for many of our insect foes and that others are kept in check to a considerable extent. But, while this is a fact, we should not be too easily satisfied and allow the pests that are only partially controlled to continue to lower the value of our orchards; but we should use the best mechanical methods to control the pests until such a time as the State Commission can secure a parasite that after a thorough test proves itself capable of subduing those remaining.

In this connection I wish to call attention to the Insectary, which has been maintained in inadequate quarters at San Francisco by the State Commission of Horticulture. At the present time a new building is being erected at Sacramento for the express purpose of accommodating this branch of the work. Too much can not be said in commendation of our State Commission for the effort it is making to acquire perfect parasites for all of our insect enemies. Continuous search is being made all over the world to secure better parasites for some of the scale insects, as well as additional ones for others. Comparatively little is known by most of our people of the difficulties to be overcome in this work. Sometimes it is difficult to get permission in some of the foreign countries to make the search. Then, after the parasites have been located, methods have to be devised to transfer them in good condition to San Francisco. Some of them have been sent on cuttings, some on infested trees, and sometimes they have been collected in boxes and placed on ice, thus keeping the insects frozen until they arrive at their destination. The next difficulty is food for them, and sometimes it happens that considerable effort must be made to secure this food in sufficient quantities and in such condition that it will keep until used.

The new building is planned for convenience in breeding and caring for these insects, and it is to be cared for by those eminently qualified for the work, both through experience and technical knowledge. We may all rest assured that everything is being done by the State Commission, and will continue to be done, to advance this line of work for the benefit of the orchardists all over this, the greatest fruit-growing State in the world.

In closing I want to quote a sentence that appeared in an article by J. H. Comstock in the American Naturalist for December, 1888.

He said: "We hope that the time is near when the *need* of an insectary for entomological work will be as fully appreciated as is the necessity for a propagating house for the horticulturist or a conservatory for the botanist." I will just add "Them's my sentiments."

PRESIDENT JEFFREY. Prof. A. J. Cook, of Claremont College, connected with the biological work, will lead the discussion.

PROF. A. J. COOK. Ladies and Gentlemen: The subject of the red scale and yellow scale is one of very great interest. In our section we have no red scale immediately around Claremont, but we have quite a good many of the yellow scale. Our people feel that there is no danger, that we have a parasite that is mentioned by Mr. Pease in his admirable paper that will keep that in control. I was in a section a few days ago where the orchards are seriously affected with this yellow scale, so it seems to me we ought to know something about this scale, so I bethought me that Mr. Bemis, our able commissioner of Los Angeles County, would tell us something about that scale. I will call upon Mr. Bemis, who will give us something on the yellow and red scale. I ask him to do this in about five minutes.

MR. C. E. BEMIS. Ladies and Gentlemen: Perhaps five minutes is all that is necessary for me to tell all I know about this, but still I believe in my crude way of telling it perhaps I ought to have a little more time. I want to preface what I say by the statement that my experience with these two pests, and any other pests I have a knowledge of, has been acquired entirely within Los Angeles County. As Mr. Pease has said to us many times, the effects of parasites on different scales are quite different in different localities, so that any conclusion I may have arrived at in my knowledge of these two insects might not apply in every case or in other localities. But I would like to say this, that this seems to be rather a new question and always open to different conclusions as to whether there are two scales, so-called, the red and the yellow, or whether they are one.

My belief is that they are two decidedly different and distinct kinds of scale, although they resemble each other almost precisely in appearance. I believe I can safely say that they differ enough in appearance, so that any of us who are careful enough in the search for them may be able to determine which is which, whether we ought to be much alarmed about them or little. The work of the two scales is so different that they do not come in the same class at all. One of them is practically a harmless insect, and the other is the worst that is known to California. The red scale, as Mr. Pease has said to you, does not confine itself to the fruit or the leaf, but attacks the tree directly from its limbs, and not only the small limbs, but the very large ones. As it grows in size, the infection will finally destroy a considerable portion of the tree, particularly the lower and the northern parts of the tree, so I think the tree could become entirely destroyed by it.

You never see any such results from the attack of yellow scale—never to my knowledge. I have heard of some cases in the northern citrus district, where they are so much worse than they are down here, that possibly my predictions would not be carried out if you would go up there and look at them. Still, I find men who are familiar with them saying that the yellow scale is almost entirely confined to the leaf and the fruit in their attack. This being the case, your tree will suffer simply from the drain from the fruit and leaves. The tree will not materially suffer from the attack of the yellow scale, while the red scale can easily kill the tree in time.

Now, in the particular locality where I have been in the business of growing oranges for twenty-two years or more, that is, the portion of the San Gabriel Valley this side of the river, we have had for probably fifteen years a general infection of yellow scale. Mr. Pease has said it came into the lower end of the valley more especially from Sierra Madre. I can remember when oranges grown there were entirely worthless on account of attacks of yellow scale. Afterwards the parasite was introduced in that particular place, and in a few years the yellow scale ceased to be a great pest in that section of the country. The fruit became suitable for us to market, and was all right in so far as the yellow scale was concerned. So I am satisfied in that particular case the parasite succeeded in destroying that scale. Now, they gradually worked across the river. I remember distinctly when the first one was found on the east side of the river, and it alarmed us directly because we all understood that it was the red scale, and we knew of the attacks of the red scale in what is now Orange County. In old times that country was terribly scourged with red scale, and we were very much alarmed about it when we learned the red scale had come into our orchards. We have had the yellow scale ever since that time in there, had it in the part of that valley, and I want to say to you that that district furnishes the largest body of citrus orchards profitably producing in the world, except one, and that is the one surrounding us now. So I think I have a good field from which to observe, and I believe I can go farther and say that the productions from those orchards to-day are and have been as great, if not greater, than any other equal acreage in the world. I say this because I want to emphasize that the yellow scale is practically harmless.

So it seems to me very important to know, if we can, the difference between these two scales; that is to say, to be able to discover the difference so as to know whether we have this worst enemy, or the one that can be most easily gotten along with. There are several distinct differences in appearance in these scales which might interest you more than what I can say about the results. In the first place, the yellow scale is a much more superficial scale; it is flatter and thinner than the other. In every case in which it is alive, especially when the female is alive, it is translucent or almost transparent. This is never the case in the red scale; this is always opaque or very murky in its color or appearance, so you can not look through the structure of that scale and see the form of the insect inside. You can in almost every case in the yellow scale. This alone will guide you largely in determining in your own orchard whether it is one or the other. Then, too, a closer examination will reveal the fact that the red scale has a very much harder covering—a much harder shell than the yellow one. If you break that cover or that shell with the point of a pin or a sharp-pointed knife you can hear a distinct crack every time; and you can't do that in the case of the yellow. In almost every case you will find that when you break the shell of the red scale the juices will emerge. It won't do so in the yellow; it comes out from under. There may be some cases where that is not true, but it is so nearly true that I believe you can lay it down as a rule, so if you should examine these scales in that way you will see a decided difference. The red scale seems to be more deeply set in its place on the fruit, leaf or limb. It is very much more securely attached.

But in the case of the yellow scale, it is more easily dislodged, and especially so in the presence of the parasite spoken of by Mr. Pease. If you have that parasite, you will find at short intervals that the scales will have become so parasitized that they will strip off easily. You can take your thumb and move it across the surface, and you will get the scale off on your thumb.

Now, in the case of yellow scale of the orange, before it goes to the packing house, this little chalcid fly has destroyed practically every one of the yellow scales, so when it goes through any kind of a brusher in the house they will readily leave the fruit. Brushing never removes any of the red scale. That always stays after it goes through the brusher or washer. It is there to stay unless you kill it in some way.

Lemons are picked every month or every three weeks, and it may be that you can not always depend on the parasite removing the scale, so in some cases it might become a serious pest on the lemon. But so far as our district is concerned, we find very little of the yellow scale on the lemon.

Our orchards, as I said before, are producing as much in every way as any in the world. This shows that the yellow scale has not interfered with the industry at all, so far as the orange is concerned. I don't know that I ought to say any more. Perhaps I have said too much already.

PROFESSOR COOK. I am glad Mr. Carnes is here. I call upon him to discuss this subject.

MR. CARNES. In the work of rearing these parasites we get acquainted with them. This little fellow under discussion at the present time is not the true parasite of the yellow scale. It is doing good work on other things, yet at the same time it does not in a great many sections thoroughly control the yellow scale, especially in the northern portion of the State, as was spoken of by Mr. Pease. These little insects have to be assisted. You have to stock the orchards and carry the parasites back and forth to get them thoroughly established. In that way you may expect to get results from them. When it comes to the direct question of depending on the parasite instead of fumigation for the yellow scale, I would be governed largely by conditions. If your orchard is badly infested with the yellow scale so that the trees are being injured, I myself would not wait for the parasite. In Riverside County I understand the parasite has held it in control for the past ten or twelve years, excepting in new sections which the parasite has not reached. In those sections they fumigate, for the reason that it is not safe to wait. The more food you have in an orchard for a parasite, the better it works. If I had an orchard where it was absolutely covered with yellow scale, as bad as some of them are, it would appear to me to be foolish to wait for the insect pest. You can't afford to wait for the parasite.

In the past, the work of parasitism has been largely exaggerated. They are a great help, and we must figure upon them as a help until we can find true parasites.

In the case of the red scale parasite that we worked on last year—the last introductions from China—I never saw any better work on red scale. We took that to San Diego County and turned it loose.

Examinations have shown that it has not taken hold. However, there may be conditions that cause that. The right conditions may not have existed when we put them out. The way to do is to follow that up. We have another shipment of the same material now at San Francisco, and are going to restock the orchards again. We went down there into a district where it didn't make much difference whether they fumigated or not. We tried to get them into an orchard that was abandoned, as a test place, to give them a trial, and if they succeeded, then it would be time to trust to that parasite. But, in the mean time, we can't wait for parasites until we have taken them to a place and given them a good trial.

MR. MILLS. What success have you had with the parasites that you have taken to San Diego?

MR. CARNES. At the last examination we were unable to find any work to amount to anything. The parasite that came in from China looked better than any one I had seen. Mr. Cundiff saw it, as did a great many other gentlemen. I think Mr. Allen saw it. It was a big, robust parasite, and we saw them ovipositing in the scale. Of course they are liable to pass from tree to tree and they may show up later. Then climatic conditions make some difference. There may be conditions at the time of placing them in the orchard that they have to overcome. The work of introducing them in the past has not been as successful as we would like to see. It is very hard to get a sufficient start. Instead of sending one shipment in and trusting to that to do the work, we should follow up those shipments, and try it over and over again.

MR. MILLS. You have some parasites for the red scale?

MR. CARNES. We have never had very many for the red scale. This one comes from the north of China, which place seems to be the home of the red scale. It seems to be a big, robust fellow. It is a new thing, and we can not tell yet what it will do.

MR. MILLS. Has the shipment been sufficient to try it thoroughly?

MR. CARNES. The work has been largely experimental. At San Francisco, in addition to our regular quarantine, and just before the earthquake, we had considerable of this stock. The earthquake destroyed practically all of our parasites. We have not had a fair trial on it. The earthquake destroyed our stock, and we had to start over again. We have never had a suitable place to propagate parasites.

MR. MILLS. Tell us about the insectary, will you, Mr. Carnes?

PROFESSOR COOK. I don't believe, Mr. President, we had better bring that in now. I don't think we had better bring in another subject that is entirely different.

MR. MILLS. All right.

PROFESSOR COOK. It is my pleasure to ask Mr. Cundiff to talk further on this subject.

MR. CUNDIFF. In speaking of the yellow scale and the relation it bears to this subject, I can do no better than to relate our experience here in Riverside. When I first became attached to the horticultural force of this county, something like fourteen years ago, the yellow scale was not regarded as injurious, but the red scale was a very serious pest, and we were fighting it as persistently as possible by fumigation. I want to say now that we always regarded it as a much more resistant scale to fumigation. It required a larger dose of material.

As I remember, thirteen years ago reports came to us that there was a parasite in the San Gabriel Valley that was attacking the yellow scale and doing good work. Mr. Havens at that time was the commissioner, and he went down and brought up a large amount of material. With that kind of an internal parasite, it was necessary to bring up the branches and the leaves. I think, perhaps, I had the honor of putting out the first colony that was put out in Riverside, and in orchards where it had been costing quite a large sum of money annually to keep the scale down. Many of them we have never fumigated since. It has certainly been a success in the main. There are seasons when, on account of conditions, climatic or otherwise, this chalcid fly does not work as well as at other times. It is not as constant in its work as some other insects. But where it loses out one year, it begins again the next. To such an extent has it been a success that my inspectors have instructions not to take up yellow scale except in new districts—districts where we have never found any of the red or yellow. In cases of that kind, where we find a few trees, their instructions are to mark them up, and then we fumigate or spray.

Now, this chalcid fly, being an internal parasite, has to go through transformations under the scale. Take the *Eulecanium*, for instance, or the brown scale, or the apricot scale, and an insect of that nature can not escape except by eating its way out and perforating the scale. But it is not so with the insects of the same family that attack the diaspidis or armored scales. I have seen many cases where the parasite that attacks the yellow scale was planted everywhere, almost covering the leaves. You could raise the scale and find a full-fledged mature insect, and the nature of that scale is that after death many of the diaspid scales, as far as I know, do not adhere to the twig or leaf closely, in the same way that the *Eulecanium* does. With the *Comys fusca*, the *Eulecanium armeniacum* will hold on for months after the eggs are hatched. The red or yellow scale will not do that. It loosens up and gives the parasite an opportunity to emerge through the scale.

PROFESSOR COOK. I am glad to introduce the next gentleman. He has done us a large amount of good. Mr. Maskew is doing good work, and he will discuss this subject as to whether we should continue to import species.

MR. MASKEW. Ladies and Gentlemen: To give you my opinion of the present status of parasitism throughout the State of California would consist simply of a résumé of Mr. Pease's paper. He covered the

ground very clearly, and for the sake of brevity I will just make a résumé.

In the case of the apricot and plum tree, the status of parasitism is very good. The *Comys fusca*, in the *Eulecanium armeniacum*, has got the pest under commercial control. In the peach and apple sections, where the San José scale is, parasitism is commercially complete. In the grain fields, something that we entirely overlooked, the status of parasitism five years out of six is complete. The status of parasitism in the great melon fields is arriving at a stage of commercial completion. In the vegetable gardens, in the truck patches, and in the berry fields parasitism is approaching approximately commercial control.

Now, we get to the great citrus belt. The status of parasitism in the citrus orchards, in my opinion, is this: "The United States Department of Agriculture, through the Bureau of Plant Industry, has proven to you that to have your fruit carry well, and hence sell profitably, it must come to the packing house clean. The citrus orchards of Southern California to-day can not send the fruit to the packing house clean. You can draw your own conclusions from that.

Now, as to the desirability of introducing more of our insect friends. In my opinion, that should be pursued diligently under all circumstances. As Mr. Carnes told you in relation to the shipments from China to San Diego, he and I were intimately associated in the handling of those, and he is correct when he tells you that never did we see such complete and thorough parasitism upon the red scale as occurred upon the plants that came to us from China. We got the insects from those; we propagated them; we liberated them under good conditions; actually saw them ovipositing. All that human agency could do we did with those small insects in San Diego County. Up to the present time we have not found any results there. However, that is no reason that we should stop. Compere should have been kept right where he was, and by every steamer should have sent us such material as that. If they can accomplish that upon those plants in China, they can do it here; and I say we should pursue that in every way, and continue to do it. Gentlemen, I thank you.

PARASITIC CONTROL OF INJURIOUS INSECTS.

By PROF. A. J. COOK, of Claremont.

Since meeting with you before at Fresno I have been widely over our own country, and over much of the finest parts of Europe, and I am glad to bring these truths to your ears: For beauty of scenery, salubrity and perfection of climate, for productivity of soil and cash returns in agriculture, for superiority of its pomology, and for the skill and intelligence of its orchard management, California is not surpassed by any other section of the world. It is, then, more than duty—it is a grateful privilege—to do aught that we may to better our condition and prospects pomologically.

It is estimated that the gross returns from our orchards alone reach annually from sixty million dollars to seventy-five million dollars. Half this comes from the citrus groves. The entire agriculture of the State

hands over to the treasury of the nation a much larger sum. If it is true, then, that our country receives at the hands of agriculture seven billion dollars annually, and if, as is shown by experts, we suffer a loss of one fifth of this because of insect ravages, then surely the question of insect control is a momentous one. California is to the fore front in this enormous production; except for her intelligence and enterprise, she would also excel in loss by her insect foes. It is also true that we spend—wisely spend—thousands of dollars annually to hold these pests in check. I know of a single orchard where $22.000 to $33.000 have been expended annually to protect against these ubiquitous foes.

Mr. Ehrhorn, in his valuable address at the Marysville meeting, and our wideawake Commissioner Pease here to-day, have shown us what substantial aid has come to us from our insect friends—predaceous and parasitic—and surely the astute orchardist will receive valuable suggestions which should lead to more valuable action in the premises.

It is desirable that we have the correct names of such insects as filch from our hard-earned possessions, as also of our insect friends, and so I make no apology for appending the following tables, with the annotations. I will first give the destructive insects that I have myself seen at work, the most of which, and the most destructive of which, are the several scale pests:

Common Name.	*Scientific Name.*	*Family.*	*Plants Attacked.*
Flûted, white or cottony cushion, Scale	I-cé-ry-a púr-cha-si	Cóc-ci-dæ	Citrus, rose, grass, acacia, etc.
Mealy-bugs	Pseu-do-cóc-cus (Dac-ty-ló-pi-us) cít-ri	Cóc-ci-dæ	Citrus, coffee, tobacco, ivy, etc.
Maple Scale	Pul-vi-ná-ri-a in-nu-mer-áb-i-lis	Cóc-ci-dæ	Tobacco, ivy, apples, etc.
Soft or Soft Brown Scale	Cóc-cus (Le-cá-ni-um) hes-pér-i-dum	Cóc-ci-dæ	Citrus, oleander, ivy, camellia, etc.
Apricot Scale	Eu-le-cá-ni-um (Le-cá-ni-um) ar-me-ní-a-cum	Cóc-ci-dæ	Apricot, pear, plum, cherry, prune, etc
Frosted Scale	Eu-le-cá-ni-um (Le-cá-ni-um) pru-i-nó-sum	Cóc-ci-dæ	English walnut, apricot, apple, pear, etc.
Hemispherical Scale	Sais-sé-ti-a hem-i-sphér-i-ca	Cóc-ci-dæ	Orange, oleander, cocos, ferns, peach, etc.
Black Scale	Sais-sé-ti-a (Le-cá-ni-um) ó-le-æ	Cóc-ci-dæ	Citrus, oleander, olive, apple, pepper, etc.
Oleander or Ivy Scale	As-pi-di-ó-tus héd-e-ræ (A. né-ri-i)	Cóc-ci-dæ	Oleander, ivy, orange, acacia, apple, plum, olive, etc.
Walnut Scale	As-pi-di-ó-tus júg-lans ré-gi-æ	Cóc-ci-dæ	Walnut, apple, apricot, cherry, etc.
San José Scale	As-pi-di-ó-tus per-ni-ci-ó-sus	Cóc-ci-dæ	Most deciduous fruits and many others.
Greedy Scale	As-pi-di-ó-tus rá-pax	Cóc-ci-dæ	Citrus, apple, cherry, ivy, walnut, etc.
Red Scale	A-ón-i-di-él-la (Chrys-óm-pha-lus) (As-pi-di-ó-tus) aû-rán-ti-i	Cóc-ci-dæ	Citrus, apple, rose, olive, fig, etc.
Yellow Scale	A-ón-i-di-él-la (Chrys-óm-pha-lus) (As-pi-di-ó-tus) aû-rán-ti-i cit-rí-nus	Cóc-ci-dæ	Citrus, euonymus (eu-ón-y-mus), etc.

Common Name.	*Scientific Name.*	*Family.*	*Plants Attacked.*
Purple Scale	Lep-i-dós-a-phes béck-i-i	Cóc-ci-dæ	Citrus, oak, banksia rose, etc.
Pear Slug	Er-i-o-cám-pa cér-a-si	Ten-thre-dín-i-dæ	Pear, cherry.
Cabbage Butterfly	Pí-e-ris rá-pæ	Pa-pil-i-ón-i-dæ	Cabbage, rape, etc.
Willow Butterfly	Eu-va-nés-sa an-tí-o-pa	Nym-phál-i-dæ	Willow, elm.
Variegated Cut-worm or California Army-worm	Per-íd-ro-ma saú-ci-a	Noc-tú-i-dæ	Oranges, alfalfa, garden vegetables.
Codling Moth	Car-po-cáp-sa po-mo-nél-la	Graph-o-líth-i-dæ	Apple, pear, quince, etc.
Hessian Fly	Cec-i-do-my-i-a de-strúc-tor	Cec-i-do-my-í-dæ	Wheat stem.
Mexican Orange Fly	Try-pé-ta lú-dens	Try-pét-i-dæ	Orange fruit.
Apricot Beetle	Sér-i-ca fim-bri-á-ta	Scar-a-baé-i-dæ	Grub eats roots; beetle, foliage.
Apricot Beetle	Sér-i-ca míx-ta	Scar-a-baé-i-dæ	Grub eats roots; beetle, foliage.
Lawn White Grub	Li-gy-rus gib-bó-sus	Scar-a-baé-i-dæ	Grass roots, foliage.
Twelve-spotted Leaf-beetle	Di-a-bró-ti-ca só-ror	Chrys-o-mél-i-dæ	Garden foliage, melons, etc.
Grape Flea-beetle	Hál-ti-ca cha-lyb-e-a	Chrys-o-mél-i-dæ	Grape foliage.
Fuller's Rose-beetle	A-rám-i-gus fúl-ler-i	O-ti-o-rhyn-chi-dæ	Roots of rosaceous plants, foliage of orange, etc.
Bean Weevil	Brú-chus ob-téc-tus	Brú-chi-dæ	Beans in pod.
Pea Weevil	Brú-chus pí-si	Brú-chi-dæ	Peas in pod.
Wire Worms, Click Beetles	Mel-a-nó-tus sp.	El-a-tér-i-dæ	Alfalfa, etc.
Bigheaded Borer	Chrys-o-bóth-ris fem-o-rá-ta	Bu-prés-ti-dæ	Apricots, apples, pears, etc.
Plant Lice	Phyl-lox-é-ra vas-tá-trix	Aph-i-dí-i-dæ	Grape.
Plant Lice	A-phis sp.	Aph-i-dí-i-dæ	Melons, peas, etc.
White Fly	Al-ey-ró-des cít-ri	Al-ey-ród-i-dæ	Orange, etc.
False Chinch Bug	Nys-i-us de-strúc-tor	Ly-gaé-i-dæ	Grapes and many garden vegetables.

In giving this list, I have given the pronunciation, as I have had frequent inquiries from our numerous horticultural commissioners and inspectors regarding the same. In the names contained in these lists, the long English sound is to be given to vowels in accented syllables ending in a vowel, as in Le-cá-ni-um; when final, as in béck-i-i; and in final es, as in Al-ey-ró-des; elsewhere, in general, the short sound, as in Cóc-ci-dæ; ch has the sound of K, as in Chál-cid; g before e, i, y, æ, or œ has the sound of j, as in Li-gy-rus; œ and æ are pronounced like e, as in koéb-el-æ.

The frequent and perplexing changes in names are necessary. There are two reasons for such changes, both of which are conclusive: one, the law of priority; the other, the avoidance of duplicating names in closely related groups. Of course the necessity of uniformity makes it imperative that we have some rule which shall be observed by all. Let me add that in writing a name, the first or generic name should always be

capitalized; the species never. Even if we could have *Vedalia roosevelti* or *Vedalia powelli*, the r and p would be small letters, not capitals.

The next table will give our insect friends: and let me add that these friends belong to two distinct groups, the parasitic insects—those that work inside their victims, like the golden chalcid of the yellow scale: and the predaceous species—those that devour their prey, as does the cat the mouse. The *Vedalia*, and indeed all the ladybird beetles, belong in the latter group.

Of the parasitic group, we have three families: the *Chalcids*, *Ichneumonids*, and the *Braconids*: and one family of the *Diptera*, or two-wing flies, the *Tachinids*. I give them in this order in the following table:

Common Name.	*Scientific Name.*	*Family.*	*Insect Attacked.*
Golden Chalcid	As-píd-i-o-tóph-a-gus cit-rí-nus	Chál-ci-dæ	Yellow Scale.
San José Scale Chalcid	A-phél-i-nus fus-ci-pén-nis	Chál-ci-dæ	San José Scale.
Greedy Scale Chalcid	A-phél-i-nus di-ás-pi-dis	Chál-ci-dæ	Greedy Scale.
Greedy Scale Chalcid	A-phél-i-nus myt-il-ás-pi-dis	Chál-ci-dæ	Greedy Scale, etc
Apricot Scale Chalcid	Có-mys fús-ca	Chál-ci-dæ	Apricot Scale.
Live Oak Moth Chalcid	Chál-cis ǫ-vá-ta	Chál-ci-dæ	Oak Moth.
Soft Scale Chalcid	Coc-cóph-a-gus le-cá-ni-i	Chál-ci-dæ	Soft Brown Scale.
Yellow Scale Chalcid	Coc-cóph-a-gus lu-ná-tus	Chál-ci-dæ	Yellow Scale.
Yellow Scale Chalcid	Coc-cóph-a-gus au-rán-ti-i	Chál-ci-dæ	Yellow Scale.
Yellow Scale Parasite	A-phy-cus mac-u-lá-tus	Chál-ci-dæ	Yellow Scale.
Soft Scale Parasite	En-cyr-tus flá-vus	Chál-ci-dæ	Soft Scale.
Yellow Scale Chalcid	Sig-níph-o-ra cal-i-fór-ni-ca	Chál-ci-dæ	Yellow Scale.
Cabbage Butterfly Chalcid	Pter-ôm-a-lus pu-pá-rum	Chál-ci-dæ	Cabbage Butterfly.
White Scale Chalcid	Les-tóph-o-nus i-cé-ry-æ	Chál-ci-dæ	White Scale.
White Scale Chalcid	O-pho-ló-si-a cráw-ford-i	Chál-ci-dæ	White Scale.
Scutellista	Scu-tel-lís-ta cy-á-ne-a	Chál-ci-dæ	Eggs of Black Scale.
Black Scale Chalcid	Tom-o-cé-ra cal-i-fór-ni-ca	Chál-ci-dæ	Eggs of Black Scale.
Diabrotica Chalcid	Cel-a-tó-ri-a cráw-i-i	Chál-ci-dæ	Twelve-spotted Leaf-beetle.
Codling Moth Parasite	Cal-li-e-phi-ál-tes més-sor	Ich-neu-món-i-dæ	Codling Moth.
Oak Moth Parasite	He-mít-e-les ash-méad-i-i	Ich-neu-món-i-dæ	Oak Moth.
Oak Moth Parasite	Pímp-la con-qui-sí-tor	Ich-neu-món-i-dæ	Oak Moth Caterpillar.
Aphid Parasite	A-phíd-i-us sp.	Bra-cón-i-dæ	Plant Lice.
Army-worm Ta-chi-na	Win-thé-mi-a 4-pus-tu-lá-ta	Mús-ci-dæ	Army-worm.
Cut-worm Parasite	Fro-tín-i-a frénch-i-i	Mús-ci-dæ	Twelve-spotted Leaf-beetle.

The Tachina flies lay their eggs on the outside of their victims, while the others usually place them within the bodies of the insect parasitized.

Many predaceous species belong to the bee and wasp order, *Hymenoptera*, and include all the wasps: the two-winged order, *Diptera*, where we find the *Syrphus* flies, and the robber flies, the latter of which even kill bees; and the order of beetles, *Coleoptera*, which includes the army-worm destroyer and the ladybird beetles. To the family of the ladybird beetles belong the well known *Vedalia*. We also have many bugs and lacewing flies, which are predaceous. I give the following table of the most important ones:

Common Name.	*Scientific Name.*	*Family.*	*Insect Attacked.*
Army-worm Destroyer	Cal-o-só-ma sem-i-láe-ve	Ca-ráb-i-dæ	Army-worm, Caterpillars.
Many Ground Beetles	Various species	Ca-ráb-i-dæ	Caterpillars, etc.
Twice-stabbed Ladybird	Chi-lóch-o-rus bi-vúl-ne-rus	Coc-ci-nél-li-dæ	Black Scale.
Imported Chinese Ladybird	Chi-lóch-o-rus sím-i-lis	Coc-ci-nél-li-dæ	San José Scale.
California Ladybird	Coc-ci-nél-la cal-i-fór-ni-ca	Coc-ci-nél-li-dæ	Plant Lice.
Red Ladybird	Coc-ci-nél-la san-guín-e-a	Coc-ci-nél-li-dæ	Plant Lice.
Mealy-bug Ladybird	Cryp-to-láe-mus mon-trou-zié-ri	Coc-ci-nél-li-dæ	Mealy-bugs.
Pilate's Ladybird	Ex-o-chó-mus pi-lá-te-i	Coc-ci-nél-li-dæ	Black Scale.
Mealy-bug Ladybird	Hy-per-ás-pis lat-er-á-lis	Coc-ci-nél-li-dæ	Mealy-bugs.
Ambiguous Ladybird	Hip-po-dá-mi-a am-bíg-u-a	Coc-ci-nél-li-dæ	Plant Lice.
Spotted Ladybird	Hip-po-dá-mi-a con-vér-gens	Coc-ci-nél-li-dæ	Plant Lice.
Vedalia	Nŏ-vi-us (Ve-dá-li-a) car-di-ná-lis	Coc-ci-nél-li-dæ	White Scale.
Koebele's Ladybird	Nŏ-vi-us koéb-e-læ	Coc-ci-nél-li-dæ	White Scale.
Steel-blue Ladybird	Or-cus cha-lyb-e-us	Coc-ci-nél-li-dæ	Red Scale.
Spotted Orcus	Or-cus aus-tra-la-si-æ	Coc-ci-nél-li-dæ	Black Scale.
Rhizobius	Rhi-zó-bi-us ven-trá-lis	Coc-ci-nél-li-dæ	Black Scale.
Purple Scale Rhizobius	Rhi-zó-bi-us lo-phán-tæ	Coc-ci-nél-li-dæ	Purple Scale.
Small Rhizobius	Rhi-zó-bi-us déb-i-lis	Coc-ci-nél-li-dæ	Black Scale.
Mite Ladybird	Scym-nus vá-gans	Coc-ci-nél-li-dæ	Bryobia Mite.

There are numerous bugs that help to keep down our various pests. The lacewings, also; especially the *Chry-só-pa* flies or green-wing *Chrysopa* is of special note as an enemy of the plant lice.

Mr. Pease has called attention to the fact that most of our dreaded pests, many of which would be terribly serious, are held in check almost entirely by their insect enemies. The soft brown scale and the cottony cushion scale are striking examples. Both of these scales are exceptionally prolific; yet both are rendered harmless, and the last by an imported species, the *Vedalia*. There are four species of scale insects,

the red, purple, black and yellow scale, which, when present, seriously injure and in time ruin our citrus groves. Thus, in many sections, immunity from harm means great annual expense. Massachusetts, after spending well toward a million dollars in combating the gipsy moth and the brown-tail moth, has now done what California's experience might have suggested at the start, imported their European enemies, and already substantial progress is made in overcoming these two alarming scourges. The devastation of the cotton boll weevil of the Southern States was so threatening that large appropriations have been made by Congress to secure effective remedies against it. We now have the encouraging report that native parasitic and predaceous species have come to the rescue, and are promising to be effective in staying the evil wrought by this snout beetle. We should remember always that these insect friends "work for nothing and board themselves." We are grateful for the discovery of such efficient remedies as gasing with cyanide, but how much more grateful for the introduction of such species as the *Vedalia,* for we are thus saved all anxiety as well as the great expense and labor of fighting our pests. We must gas, unless our friends are masters of the situation. To wait for the *Scutellista,* or golden chalcid, until our groves are ruined, or materially injured, by the black or yellow scale is the height of folly. The wise course would seem to be to fight our pests by the best method, unless their enemies are sufficient to keep them down; and in case we do not now have efficient parasites or predaceous species, to hunt for them with the keenest vision that we can secure.

This brings me to the climax of the whole matter. We must listen to the wise words of Prof. Vernon L. Kellogg spoken at the Marysville meeting; we *should have* at once a STATE ENTOMOLOGIST. Think of it! Despite all the losses, our gross returns from our orchards are something like seventy-five million dollars. If, as good authority has it, twenty per cent of this sum, or one fifth, is sacrificed through insect ravages, then we see that our annual loss is from twelve to fifteen million dollars. When we add to this the immense sum expended yearly in fighting our foes, we have data that should induce immediate action. We can not estimate the great benefit that has come through Harris, Fitch, Walsh, and Riley, not to mention a host of other workers in this important field. Millions would not measure the benefit to our country derived from Riley's extensive researches, while State Entomologist of Missouri. With so much at stake, we should see to it at once and insist that we have the most competent man that we can procure, and equip him, as suggested by Professor Kellogg, with assistants and means to travel and investigate, and should pay a salary that would secure the ablest talent to be found. This man should be free from the influence of politics and responsible only to the fruit growers. His whole time and energy should be devoted to research in practical entomology. The professor at the University has teaching that distracts, and our able entomologists, now connected with the State Horticultural Commission, have duties in relation to quarantine and breeding insects that disqualify them for this huge work. It is a field that would take the entire time and tax the energy to the utmost of the best man that can be secured. With the right man, millions might—nay, would—be saved annually to our fruit growers. When we consider our immense orchards, the enormous pro-

duction, and the frightful loss from insect ravages, it seems strange that our fruit men, usually so full of enterprise and energy, have not, long ere this, insisted that we have a State Entomologist, who shall give his entire time to the study of our insect foes. We learn with great satisfaction that the University is to send to our part of the State a very competent entomologist to engage in this most promising field of research, who shall give his entire time to such investigations. It would be wise economy if the horticulture board should add to their present force a man to give his entire time to field work and investigations concerning insects.

PRESIDENT JEFFREY. Before we adjourn, I wish to announce the committee on the President's address, covered by the motion of Mr. Mills. I have selected J. H. Reed, C. E. Bemis, and George C. Roeding. If this is acceptable to the Convention, that committee will stand; and if you wish to consult Mr. Mills about any idea he may have regarding this address, I think he would be glad to help you. Remember to-morrow is citrus day, and all be here on time.

(At this time an adjournment was taken until Wednesday, April 29th, at 9:30 o'clock A. M.)

PROCEEDINGS OF SECOND DAY.

WEDNESDAY, April 29, 1908, 9:30 o'clock A. M.

The Convention was called to order at 9:30 A. M. by the President, and the following proceedings were had:

PRESIDENT JEFFREY. We are now ready to take up the programme for to-day. The first is the paper by Mr. Reed, and it will be discussed by Mr. Powell and Mr. Eustis. Mr. Powell's voice is not in good condition, and he has asked Mr. Eustis to read his paper. Mr. Powell will be here, and will assist in the explanations from the charts.

THE PROPER HANDLING OF CITRUS FRUITS.

BY J. H. REED, OF RIVERSIDE.

The principal effort in pomology in this country, during last century, was to secure improved varieties of fruits. The wild strawberry we hunted in the meadows in our childhood days, however delicious to our untrained tastes, was not altogether satisfactory. The very *thought* of the seedling apple of years ago brings a quick scowl, till the recollection of the good times of the old-fashioned paring bee, and the long straws thrust into the bungholes of the barrels of sweet cider at the old cider mill, turns the scowl to a smile.

Within my own recollection the family orchards were largely composed of seedlings. Here is a photograph of an apple tree which grew from a seed brought by my grandmother from Connecticut and planted by the side of her little log cabin in the woods of Ohio 105 years ago. In those early days its fruit was considered quite wonderful. But while the apples sent me from it, with accompanying photograph, last year were delightful to look at, because of old associations, we had no desire to taste them. In this way those early orchards were started. But then, as now, there were those who wanted something better than they had, and went straight about getting it. The grafter—not the modern sort—but with his saw, and scions, and wax pot, began to put in his annual spring appearance.

The old seedling fruit had good carrying qualities. We could shake it from the trees, pile it into the ox cart, haul it to the cellar, pour it into the big bins, use it during the long winters, and have sound fruit to feed to the pigs in late spring. When the grafted branches began to bring us Pippins and Pearmains, we soon found it best to pick instead of shake them from the tree, and store them more carefully. This improved fruit began to be called for in the cities, and commercial orchards of budded stock were planted throughout the middle and the then western states, and a great industry was established. This is no place to go into its varied history, though it is of exceeding interest, and

not without lessons that may be profitably studied by our comparatively little citrus industry.

It was in connection with this greater winter apple business that the Department of Agriculture rendered one of its most important services to American agriculture. I may be pardoned for referring to this, because it was through the leadership of our Mr. Powell, in the scientific investigations of a few years ago, that the methods of handling winter apples, especially in cold storage, were revolutionized, and thus the most important fruit industry of the country placed on a firmer and more profitable basis than ever before. Mr. Powell is known and esteemed to-day in all the winter apple-growing sections of our country, as he will be in California orange-growing districts in years to come.

To some extent the brief history of our California citrus industry has been similar to this. The seedlings in early days were considered pretty good fruit. They would endure much hard usage. In Old Mexico I saw oranges brought twenty and thirty miles in sacks on pack mules, and piled up at railroay stations to be shipped like potatoes, yet they reached distant markets in fair condition. Many of our own seedlings will stand treatment that would ruin our improved varieties. There are two ways in which we may ward off damage to our more delicate modern citrus product. We may breed out these delicate characteristics, securing varieties that would endure rough handling. While this would be at the expense of desirable qualities, had we no other recourse, it probably would be the wise thing to do.

Professor Hanson, that grand man of South Dakota, who is accomplishing such wonders for horticulture in that great empire of the Northwest, is trying to secure a hardy apple that will endure the cold winters of that north country by crossing delicate varieties with the unedible fruits of that region. Judging from what he has already accomplished, there is little doubt about his succeeding. But no one expects him to produce anything to take the place of the California Bellefleur, or any other variety raised under favorable conditions, sought for by fruit lovers.

Some Southern California growers have been a little nervous over the possible outcome of Dr. Webber's new variety of hardy orange that may be produced throughout the temperate regions. No doubt he has produced a wonderful new fruit, but it will never take the place of our California navel. Though this beautiful fruit of ours, raised perhaps under as ideal conditions as exist, is delicate and unfitted to stand hardship, we have now been shown how these desired qualities may be retained, and yet have the fruit placed in the distant markets in perfect condition.

Instead of trying to breed into our juicy, tender fruit qualities to enable it to endure hardship at the expense of those which give our oranges their highest value, our propagators may now turn their attention to adding other delicate characteristics of flavor and beauty with assurance that they need not prove a hindrance to their profitable marketing. This may not only be known as the Powell era in the history of the California orange industry, because of the new money values his investigations have given our product, but because now we may turn our attention to adding new attractiveness to our already popular fruit.

I don't know how the rest of you old orange producers feel about it, but I confess to a very shamed feeling when I think that after nearly twenty years of experience with, and somewhat careful study of, this fruit, and in spite of the tremendous annual loss we were sustaining from decay all this time, I had not sense enough to find out that all we had to do to put our fruit into the markets without decay, with an aggregate saving of millions to our industry, was to prevent injury in handling. And now, for one, I feel like trying to forget the humiliation by adding my mite towards inducing the industry, as a whole, to effectively use the tremendously valuable facts the Government had to come across the continent to show us.

Here is the finest orange picked from my little home grove near a score of years ago, and here is a Florida Russet that I cut from the Florida tree two years ago, handling it somewhat carefully that I might get it home safely. The framework of these fruits being uninjured, all germs of disease were excluded, and they remained perfect till the juice gradually evaporated after long exposure. In this little nut shell is the whole secret of our fruit decay and its prevention.

Perhaps in no instance have so marked practical results from scientific investigation been followed so quickly and generally by actual changes in methods in any great agricultural industry as we already find in the handling of our California oranges since the results of Mr. Powell's investigations into the causes of their decay have been made known. The newly discovered factor in prolonging the life of an orange, after it has been parted from the tree, has been so effectively demonstrated as to command the attention of growers in all California orange sections, to such extent as to have already radically changed methods in harvesting the fruit and preparing it for market. New laws concerning the effect of temperature have been so well determined as to materially change methods in transportation, and more than a million dollars per annum is being saved to the industry by intelligent, careful handling. It is a wonderful achievement for scientific research, and of the prompt application of its results in practice. I am proud of our Washington Department of Agriculture, and the trained young men it sends us to help us out of our serious difficulties. I am proud, too, of the few enterprising orange growers who so promptly and efficiently applied the new facts brought out by the scientists, and so quickly gave us practical object lessons demonstrating their value.

But are we satisfied, even with these prompt and splendid results, though alone sufficient to mark an era in our industry? I confess, for one, I am not. So long as there is careless picking in so many orchards; so long as we see so large a proportion of the oranges hauled from orchard to the packing house in the heat of the day, unprotected from the broiling sun and insinuating dust, in wagons without springs, and otherwise utterly unfit for their transportation; so long as crude or complex machinery, through which it is impossible for fruit to pass without mechanical injury, is found in so many of our packing houses; so long as packing houses attempt to handle twice the amount of fruit during the hurried part of the season their equipment is adapted for; in short, so long as the daily reports show that one third of the sales returned from practically the same grade of fruit average net, to the grower, more than fifty cents per box, than the average of the lower

third of the aggregate, with the highest prices uniformly going to those utilizing the careful methods most thoroughly, so long the gospel of careful handling of our oranges should be preached by every one interested in the permanent welfare of our industry.

It is not worthy of any of us to say, or think unsaid, "I have learned how my fruit may be put into the markets at a large increase of profit over old ways, and I am seeing to it that it is done. The other fellow must look out for himself. Whether he uses the improved methods, does not interest me." It should interest every generous minded man connected with the industry, and induce him to join in every effort to secure general adoption of better methods.

Some of you may question if this can be done. Most certainly it can be done. The orange growers of California are an intelligent class of agriculturists. It is true these new laws, the value of which scientists have demonstrated, are applied with more difficulty by the small grower. But when he is shown that on a product of but a thousand boxes there may be an actual saving of from $250 to $500, he is going to find a way to secure it. Besides this money view, I confess to some sentiment in this matter. The production of oranges in California, to my mind, offers the most inviting of all agricultural pursuits for an intelligent, cultivated people. That the 50,000 cars of this fruit per season, to go from California orchards in the near future, may be produced under the management of a few great landed proprietors, because of their keen, farsighted, prompt adoption of better methods, neglected by smaller growers, is not a pleasing thought to me. I prefer to think of this great product of ours, that will soon be found on the table of the wealthy epicures of all nations, because of its qualities, and on the tables of the intelligent laborer, in our own and other lands, because improved methods have insured a low cost of production and safe carriage to all countries, coming from ten thousand California proprietors, of small holdings, with an intelligent, happy household connected with each. This, I believe, to be quite possible, with all the advantages it would insure to the State, as well as to the local communities and the individual. It is for this reason, largely, that I believe special effort, individual and associated, should be made to induce the average grower of to-day to promptly utilize the improved methods, not only of production, but of handling our great orange product, which scientific investigations are so clearly demonstrating to us.

PRESIDENT JEFFREY. Mr. Reed has certainly presented this subject in an interesting manner, and we will now hear from Mr. Powell, whose experiments have done so much for the citrus growers of our State. Ladies and gentlemen, I have pleasure in introducing Mr. G. Harold Powell.

THE HANDLING OF ORANGES IN 1908.

By G. HAROLD POWELL, of Washington, D. C.

The Bureau of Plant Industry since 1904 has been investigating the decay of oranges while in transit from California. It has shown by extensive shipping experiments, and by tests of other kinds, that the decay is caused by a blue-mold fungus which usually gains entrance to

the fruit through an injury of some kind produced in handling the oranges in the groves and packing houses; that the decay is largely preventable; that a sound orange shipped quickly after picking and packing seldom develops decay; that the decay may be retarded temporarily in injured oranges if they are refrigerated quickly after picking and packing in warm weather; and that the fruit that keeps the best after it reaches the market is the fruit that is handled the most carefully in California. The results of the investigation have been published each year in circulars. A more comprehensive treatment of the subject has been issued recently in which a discussion is presented of the work from 1904 to 1907, inclusive, and of its relation to the entire citrus fruit industry. ("The Decay of Oranges while in transit from California." Bulletin 123, Bureau of Plant Industry, U. S. Dept. of Agriculture.)

It is the purpose of this discussion to present some of the conditions that have been observed in the handling of the orange crop while carrying forward the experimental work of 1908.

It appears to be quite generally accepted by leading growers and shippers that the decay of oranges can be prevented by handling the fruit with enough care from the tree to the car to preserve the natural resistance which the orange has when it is severed from the tree, and by shipping the fruit quickly after picking and packing. It is probably not overstating the facts in saying that the methods of handling the orange in the field and packing house have been radically modified since 1904, with these ends in view. More effective progress has been made in this direction in 1908 than in the years preceding.

THE CHANGES IN HANDLING THE ORANGE.

The changes of 1908 that have had a far-reaching effect on the industry have been (1) an effort to harvest the fruit by labor controlled by associations, in order to avoid the uneven physical condition that formerly characterized the fruit when harvested by the growers; (2) the more careful handling of the fruit by growers and shippers not belonging to associations; (3) the substitution of day-paid labor under competent supervision for box-paid labor, especially in the field; (4) the construction and remodeling of packing houses with machinery that handles the fruit carefully; (5) the cleaner condition of packing houses, with special reference to decayed oranges; (6) the quick shipment of fruit after picking and packing; and (7) the adoption of better methods of grading and packing by a number of individual shippers and associations. There has probably been less decay in the oranges from California in 1908 as a result of these changes than ever before, notwithstanding the fact that many prominent shippers were convinced at the beginning of the season that there would be excessive decay in the shipments of 1908 on account of the advanced maturity of the fruit.

EXAMPLES OF REFORMS.

It has been shown in 1908 by a large number of associations and shippers that it is practical to eliminate the decay from the commercial shipments by better methods of handling the fruit, and to elevate a section that has acquired the reputation of producing poor shipping

fruit to a higher class. This has not been accomplished by the elimination of the mechanical injury of the fruit alone, but by the adoption of better methods of labor handling, of picking, of hauling the fruit to the packing house, of packing-house equipment and management, and of grading and packing the fruit. It may be worth while to illustrate a specific reform of this kind that was brought about in 1908.

For several years the representatives of the Bureau of Plant Industry have observed a large amount of decay in the fruit of an association within 40 miles of the coast. This community, like several others, acquired the reputation of producing fruit of poor shipping quality. The growers themselves, and the marketing agency, were convinced that the trouble lay in the conditions under which the fruit was produced. It was thought that the soil was too rich; that the oranges were too "fat." Ten, twenty, or thirty per cent of decay was not unusual in the cars of oranges from this association in 1907. The conditions surrounding the association were investigated by representatives of the Bureau of Plant Industry in 1907. The fruit was picked by the box by the growers. It varied in condition, showing from five to thirty per cent of mechanical injury. The hauling was badly done. The packing house was complicated with overhead sizers, a steep gravity grading-table, deep bins, a steep narrow hopper, and a poor arrangement in general. The house was littered with rotten oranges. They were under the hopper and the bins, and could be found in many out-of-the-way places. The culls were dumped near the house, and the wind blowing on them kept it filled with myriads of blue-mold spores. A large proportion of the fruit had to be washed. The shortage of cars kept the house filled with fruit both packed and unpacked. While the commercially handled fruit of this house was decaying in transit, the carefully handled oranges in the experiments of the Bureau of Plant Industry showed no more decay in 1907 than well-handled fruit from other sections of the State.

This association was reorganized in 1908. A new manager was secured. The fruit has been picked by the day, by labor controlled by the association. The packing house has been remodeled, and is in fair condition. An effort has been made to handle the fruit carefully in the packing house, and it has been shipped quickly after picking. As a result, the fruit has arrived in market practically free from decay during 1908. In fact, there has been less decay in the fruit of this house than in the oranges in a few associations located in sections that are generally thought to produce the best carrying fruit in the State, but which have made no special effort to handle the fruit carefully. The experience of this association has been paralleled by several others in the coast region in 1908. It is another demonstration that there is not so much inherent difference in the carrying quality of oranges of different sections, but that the character of the business management and the care with which the fruit is handled are large factors in determining the sort of reputation the oranges of a community shall acquire.

CONTRAST BETWEEN TWO GROWERS EQUALLY WELL LOCATED.

There are some growers or shippers in California who have either given the matter little consideration, or who prefer to doubt either the necessity or practicability of handling the orange crop economically on

a large commercial scale without injuring the fruit considerably. An example of this kind recently came to our attention, and is presented to show that such a point of view is an unwise business policy.

A grower who has a large investment in the orange business, and whose fruit was found to contain over fifty per cent of injury from clipper cuts, stem punctures, and other types of abrasions, recently said that the injury could not be eliminated without too much expense and without completely disorganizing the labor methods employed on his ranch. The superintendent of the ranch maintained also that the fruit could not be handled more carefully or economically. It is packed in a house of fairly good type and in which no special effort is made to grade or pack the fruit with more than usual care.

Let us draw a contrast between this point of view and that of a neighbor whose interests are equally large. The groves are on similar soil, and the fruit of both is similar. The second neighbor maintains that it is a poor business policy to invest a large amount of money in groves, and in their annual care, unless the fruit is picked and packed with at least enough care to preserve its natural keeping quality. He has an efficient field foreman; the labor is paid by the day; the work of each picker is checked up by an inspector in the packing house; the fruit is hauled to the packing house with great care. The packing house is of simple arrangement and installation. Every effort is made in picking and packing to keep the fruit in as good condition as it was when it was severed from the tree. The grading is done carefully, and his packing is well paid for and is done well. It probably costs the latter grower not less than ten cents a box more than his neighbor to pick and pack the fruit.

Has it paid the second neighbor to do this extra, careful work, except in the satisfaction that comes from work well done? The fruit of both growers was often sold in the New York auction market during the month of March under conditions that are fairly comparable. The fruit of the first grower is packed in a fancy brand, which includes from 20 to 30 per cent of his oranges. The second grower packs an "orchard run" brand, in which from 75 to 85 per cent of his fruit is graded. Yet the fancy brand of the first grower, containing from 20 to 30 per cent of his fruit, brought twenty-seven cents per box less than the "orchard run" of the second grower, which contained from 75 to 85 per cent of his fruit. If further evidence is needed to show that it is a sound business policy to exercise the greatest care in handling the orange crop, it may be said that there is not a grower or an association in California that ships oranges or lemons, and which has made a reputation for high-priced fruit, that has not built his success on a foundation with careful handling methods as the corner stone.

The careful handling of oranges is a matter of business method and organization. Several growers began to exercise more than the average care in 1906. More followed it in 1907, and a much greater number have fallen into line in 1908. Several examples, taken from different parts of the State, will show the character of the handling of the fruit in 1908.

EXAMPLES OF ORANGE HANDLING.

One large corporation, which began to exercise great care in 1906, and which has maintained a distinguished place in the markets, has

shown the following amount of mechanical injury at different inspections. The injuries are very slight in nature, and are usually caused by gravel punctures and body bruises of various kinds: 4.3, 1.9, 1.6, 2.4, 6.1, 4.0, 2.3, 9.6 per cent. This fruit is picked by a gang of thirty to forty Mexicans, under the direction of one foreman. It is interesting to note that the injury of 9.6 per cent was due to pushing the labor beyond the capacity for careful work during warm weather, when the fruit was dropping badly. This corporation has not had a serious amount of decay in a car of oranges since the careful handling methods were adopted in 1906, though previous to that time a decay of 10 to 20 per cent was not unusual.

The fruit of another shipper, which was rotting badly, and which acquired a famous reputation during the middle of the season of 1907, following a reorganization of the methods of picking and packing, has shown the following amount of injury in 1908: 4.0, 3.9, 5.9, 5.2, 14.0 per cent. The injury in the last inspection was largely body bruises, resulting from nails in the picking boxes, and from a lack of temporary supervision of the labor. The fruit of this shipper has shown practically no decay since the better handling methods were adopted in 1907.

The fruit of another grower, who adopted the most rigid system of careful handling in 1908, paying the labor by the day, checking the work of each picker by an inspector in the packing house, and using care in every operation, has been practically sound throughout the season. In many of the inspections there has been less than 1 per cent of mechanically injured oranges, and seldom over 2 per cent. The fruit of this grower has been packed with great care. It has a commanding place in the markets, and has arrived practically sound throughout the season.

As an indication of the work that can be done by an association, the following injury data are taken from several inspections during 1908. There are one hundred members in this association. The fruit is picked by two gangs of labor, under the control of the packing house: 3.3, 5.9, 3.2, 6.6 per cent.

The injury data following are taken from several inspections of the fruit of an association having several hundred members. The fruit of this association, when picked by the growers, often showed 30 per cent of mechanical injury. In 1908 it has been picked under the direction of the association: 8.6, 8.5, 3.6, 7.6 per cent.

The injury data following are taken from several inspections in 1908 of fruit of a large association in which the growers have picked some of the fruit. The rest of it has been picked by the association: 4.0, 10.7, 10.0, 12.4, 9.0, 16.3, 16.5, 15.6, 16.5 per cent.

The injury data following are taken at random from inspections in 1908 of fruit of individuals and associations that apparently have made no special effort to have the fruit picked carefully: 46.7, 28.1, 15.2, 59.0, 33.5, 84.7, 16.5 per cent.

THE SHIPPING EXPERIMENTS.

The results of the shipping tests of 1908 have borne out the results of the previous years, except that the decay has been less in commercially handled fruit, especially in washed oranges. This is due to the cleaner condition of the washing tanks and water, and the quicker drying and

shipment of the fruit. The following data are taken from a large number of shipments, under ventilation, from houses on the coast and in the midvalley region, in which efforts have been made to handle the fruit carefully. The shipments were made in cool weather. They included apparently sound brushed and washed fruit, commercially packed, brushed and washed fruit, and mechanically injured oranges. Duplicate lots have been shipped to New York as soon as packed, and two and four days later. The decay has been determined on the arrival of the fruit in the market:

Character of Oranges.	Delay in Shipment.			
	0.	2 days.	4 days.	Average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Brushed, apparently sound	0.1	0.2	0.9	0.4
Washed, apparently sound	0.1	0.6	0.7	0.5
Brushed, commercially packed	0.7	0.8	1.7	1.1
Washed, commercially packed	0.8	1.4	3.6	1.9
Mechanically injured	6.1	12.4	14.4	11.0
Average	1.6	3.1	4.3	

The decay in all of the shipments in the preceding table is of little commercial importance, but like the results of previous years, it shows (1) the oranges that are handled the most simply develop the least decay, while the fruit that is most injured develops the most decay; (2) the oranges shipped out quickly after packing develop little decay, while the fruit that was delayed develop considerable decay, especially the injured fruit.

THE MARKET HOLDING TESTS.

In the market holding tests of 1908, the fruit has been handled in different ways in California, and the decay has been determined on the arrival of the fruit in New York, and at the end of each succeeding week after being stored at a temperature varying from 50 to 70 degrees. The decay is invariably least in the carefully handled fruit, and greatest in the fruit that is more or less mechanically injured.

An example taken from a typical lot of fruit will suffice to illustrate this phase of the work. The data show the decay of oranges packed from the same bins, one lot representing the regular commercial pack of the house, and another lot having the visible mechanically injured oranges eliminated:

Character of Oranges.	Time of Inspection.			
	On Arrival.	After 1 week.	After 2 weeks.	After 3 weeks.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Apparently sound	0.0	2.8	6.6	10.4
Commercially packed	1.0	4.6	11.3	14.6

THE KEEPING QUALITY OF FLORIDA ORANGES.

The most striking effect of the method of handling the orange, in relation to its keeping quality, has been brought out in the investigation of Florida oranges by the Bureau of Plant Industry in 1908. The Florida orange has a thin skin and is easily bruised. The climate is warm and moist, making ideal conditions for the growth of the decay fungus. The labor conditions and the conditions surrounding the culture and marketing of Florida oranges are such that the fruit is subjected to rough handling. The packing house equipment is of the crudest type, and is one of the principal causes of the mechanical injury of the fruit.

Many of the growers and shippers of Florida, in common with those of California, have been convinced that it is natural for oranges to rot; that the decay is apparently one of the penalties that is inflicted on those who engage in the citrus fruit business. Many of them, in common with growers and shippers in California, have attributed the decay to the influence of the soil, of the fertilizer, of the location of the groves, or the section of the State in which the fruit is grown, while most of them believed that the conditions surrounding the fruit while in transit to market contributed largely to the decay.

It would not be safe to say that some weight should not be given to these explanations, as the investigation of the Bureau of Plant Industry has not extended beyond two seasons. The Florida orange, however, is acting in a manner similar to the California orange when it is handled in a similar manner. The following data show the average decay in a large number of shipments from different parts of the State to Washington, D. C., and after the fruit had been held in the market for different lengths of time. There were included in the shipment (1) oranges that were picked with great care, and were packed without being run through the packing-house machinery; (2) similar oranges that were run through the packing-house machinery; (3) oranges handled under regular commercial conditions from the same groves; and (4) oranges containing clipper cuts, stem punctures, and other types of injury:

Character of Oranges Shipped.	Time of Inspection.		
	On arrival in market.	After 1 week.	After 2 weeks.
	Per Cent.	*Per Cent.*	*Per Cent.*
Carefully handled, not packed through machinery	0.4	1.9	4.5
Carefully handled, packed through machinery	1.5	5.4	12.4
Oranges picked and packed under commercial conditions	3.9	10.6	18.1
Mechanically injured	20.2	38.0	52.4

These data from another orange-producing region indicate that the natural keeping quality of the fruit must not be injured in handling, if the orange is to have good shipping and keeping quality. An orange

that is handled in this manner brings the highest satisfaction to the producer, the shipper, and to the consumer. An orange that is made susceptible to decay by poor picking or packing is unsatisfactory to the producer or the shipper, as it may rot while in transit to market. Or, if it reaches the market in apparently sound condition, and is likely to rot afterwards, the dealer has to charge an excessive price as a protection against the loss of the orange that may rot before the fruit can be sold. It is a fraud on the consumer to sell him oranges that are apparently sound, but which, as a result of the handling the fruit received in the groves and packing houses, are likely to rot before they can be used.

There are few fruits that are naturally capable of entering more widely into commerce than the citrus fruits of California. It is a wise policy, and in the broadest interest of the permanent prosperity of the industry, that every effort be made by growers and shippers and by their associations, and by the transportation companies, to handle the fruit with enough care so that it may be distributed to the most distant markets of the world. It has been the aim of the Bureau of Plant Industry to coöperate with the various interests connected with the citrus fruit industry in working out the principles by which the products of the groves and orchards may be distributed in sound, wholesome condition over the widest geographical areas.

PRESIDENT JEFFREY. We are now ready for the next paper. It is by Mr. Rumsey, on "Packing House Equipment," and will be discussed by Mr. Dreher. Both gentlemen are here, and will give you a lively three quarters of an hour. I now take pleasure in introducing Mr. C. E. Rumsey of Riverside.

MR. C. E. RUMSEY. I would like to preface my paper by saying that if my own selfish profit was considered only when I took a packing house, I would not be here to tell my competitors anything about it. It was my interest in this trade as a whole, this magnificent industry, the unnecessary losses that were occurring in it, that made me desire to enter this work and find out for myself, and to prove what I believed could be proved.

PACKING HOUSE EQUIPMENT.

By C. E. RUMSEY, of Riverside.

Having been drafted by the State Commission of Horticulture to speak on "Packing House Equipment" at this Convention, I have accepted the duty under protest. My experience as a packing house manager does not qualify me to tell men of long experience, and in entirely different situations from my own, what they do or do not need. I can, at least, open the subject and give some details from my own experience.

The most important item of equipment is not machinery, nor any contrivance or device to hurry our perishable fruit from wagon to car. I would place absolutely, first, a body of growers who would demand from the packing house management that the fruit they had labored

nearly a year to bring to perfection should be so handled as to prevent its decay while on the way and after its delivery to the buyer.

While packing house managers have been open to blame (mainly for consenting to handle fruit improperly), it would be very hard to find a manager who would resist an effort made by his growers to insure greater care in handling. In my experience, the grower is to blame—not the manager. Some growers will help the manager by picking and delivering fruit in the most careful manner. Other growers will do neither, and their neglect, when their fruit is pooled, makes the care of other growers of no effect. I am discussing this matter from the association standpoint, having no experience with any other. I think in any association packing house, with the light we now have, a body of growers can be grouped who will agree to have their fruit picked by a crew, under the control of the manager, hauled in the most careful manner, and packed under strict rules, asking only that this be done at as little cost as the best work requires and demanding that the fruit so packed shall be sold under specified brands. If there is a group who do not believe in care, and who will not take it, or pay for it, I would let them have the brands they have always had, and adopt new ones for those who have the work done carefully. The past two years have shown that new brands, well handled, have displaced some of the old favorites, and good work is quickly appreciated by the trade. Such a body of growers will either gladden a manager's heart, or break his back if he does not respond. This is the first and best item in "packing house equipment."

The second item is the picking crew, and the main force in that is the foreman. I do not believe the best work can be done by any manager, unless he controls the fruit from the tree to the car. In no other way can you fix responsibility. The grower should do nothing but watch and help the foreman, unless he will work in the crew with the other pickers and under the foreman. The grower must expect to pay more for picking when clipper cutting and long stems are not tolerated. No picker can pick as many boxes of perfect work—fifty boxes is about the limit, and where fruit is small, it may drop to thirty-five boxes. In my own experience, constant inspection at the packing house is necessary to insure perfect work. Several times, when fruit was small, the men would pick faster than before, and we had to warn them we wanted perfect work rather than quantity. In our crew every man keeps tally of his boxes as he fills them, and also numbers them on the end in pencil, so the inspector can examine a certain number of each man's pick daily. I prefer clipper cuts to long stems. Some clipper cuts heal over, but the possibilities of the long stem to cause injury and decay are about five times as great. We cut all stems twice, and we have no leaves or twigs in the boxes. Throwing the picking sack to the left hip has cut out that source of decay. We fight the pickers all the time to keep the work right, and find it is necessary. Full boxes are ordered kept in the shade of the tree, and we have pieces of canvas that cover two and three boxes to keep off sun and dew or rain.

We haul to packing house in wagons two feet from the ground; the end gate, six feet long, drops to the ground and serves as a bridge, up which the boxes are carried and gently put in place. The wagon

holds 120 boxes, two rows wide and six high. Front wheels 48 inches diameter, hind wheels 54 inches. We use three horses abreast. Every sixth box has cleats under it, and is stenciled in black, so it can be seen anywhere, to enable the men to put these on the bottom of each tier, so we can use a truck with a twelve-inch nose to convey six boxes at a time from the wagon across the end gate (now used as a bridge) from load to packing house floor.

The elevator, the clamp truck, and the rustler, were all undesirable features in equipment. We have cut out the elevator, by dropping the floor of the house below the grading table twenty inches, so we feed on to the sizer almost horizontally. When necessary to weigh, we empty the bins and use small platform scales. All our culls are carried to a bin and reinspected by the foreman. I think I pay his wages out of the cull bin.

We use no brusher. If fruit is dirty, we grade it out and clean it. If one child is sick, it is better to dose it, and not give medicine to the entire family. We use Stebler's automatic dumper and sizer, which eliminates the desire of the human dumper to shove the fruit down with the edge of the box. We have a piece of canvas with a board attached, so that it meets the box as it comes up and covers enough of it to make the oranges crumble down inside the box, instead of flying out. They fall on rubber hose, spaced apart, to let buttons, sticks, etc., fall through at once; but clean picking has almost cut them out. The hopper below the hose grating is smooth, hardwood board, as the fruit does not fall on it.

We use Praed canvas bins. When packed, the boxes are placed on Alvey Ferguson ball-bearing roller conveyors, twenty-six inches high, the height of the press. The most perfect press I know of is made by Mr. Covey of Riverside. The fruit is clamped sideways—away from the edge of the box before it is pressed down, and it seems to prevent injury when carefully handled. When nailed, the boxes are shoved on the conveyor, and run by gravity into the end of the car if needed, or off to the side of the house to be stacked.

Not all of the work in our house is adapted to all other houses, but the determined growers, the intelligent manager, the picking crew, the careful hauling and handling, are, after all, the best equipment for any house, and when you have these, no device that can possibly injure fruit will be tolerated.

Let us pick and pack our fruit to save ourselves loss now that the Department of Agriculture has spent $36,000 to show us how to minimize decay, knowing that the trade will pay us well if we save them loss. When dealers find out that most decay is preventable, it will be hard to sell fruit that has been carelessly handled.

I presume "Packing House Equipment" was assigned to me because the Commissioner thought there was something unusual in my house in the way of "equipment." There is little in it that is original; it is only the adaptation of other men's ideas, picked up here and there, but always with the purpose of simplifying the work, and handling fruit with care. We have coddled the lemon and abused the orange. Having no lemons, we coddled what we had, and the oranges got the easy handling. They have responded, as Mr. Powell predicted they

would, and the market seems to have appreciated the care. I think the packing house equipment has been a small factor only. It is care, not equipment, that has done most to lessen decay. No equipment will take the place of anxious, systematic care from the tree to the car. I am forced to this conclusion by finding houses which have a less careful equipment than ours, but whose field care and hauling is of the best. I would rather take any packing house and pick, haul, and pack for it with care, than take the costliest equipment designed for careful handling and rush fruit through it so care could not be given.

It was a mystery to me how Mr. Chapman could sell oranges for such high prices. Then it became a mystery how the National Orange Company could get such figures. Then L. V. W. Brown put me in a brown study. I began to remember that Mr. Powell had said nearly four years ago that Mr. Chapman was the most careful packer in California. As I knew the National Orange Company and Mr. Brown were following Mr. Powell's suggestion, the proof seemed positive that there was something in it.

Later, I knew of a packer saying, "Mr. Powell is a humbug." I looked in the market report and saw this packer's fruit sold at $2.40 for extra fancy, when three orchard runs sold for over $3.00. That proved it negatively, and I built a house with an oak shield on the corner, on which in gold letters is inscribed:

"In gratitude to the U. S. Department of Agriculture, the Bureau of Plant Industry, G. Harold Powell and his Staff, this building is dedicated to the careful handling of Citrus Fruit."

It is not dedicated to "Equipment."

PRESIDENT JEFFREY. I owe this audience no apology for having forced Mr. Rumsey to read this paper. I now have pleasure in introducing Mr. P. J. Dreher, manager of the San Antonio Fruit Exchange, who will discuss this matter for ten minutes. If you have any questions, write them out and hand them in, and they will be considered.

MR. DREHER. This is rather unexpected that I should speak before you on this subject of packing house equipment, because I am not a packing house man. When I was asked to allow my name to go on this programme, I wrote Mr. Isaac that I didn't think that I was the party, and begged to be excused. Mr. Isaac said, since I had not positively declined to serve, that he would put my name on, and I suppose I might consider myself pressed into the service, and will make my remarks brief.

The best equipment for a packing house is a good, level-headed, sensible foreman. When you have that, the other is all easy. The less machinery that you put into a packing house, the better equipment you will have. It has certainly been demonstrated by the results of Mr. Powell's investigations, that the more you handle fruit the more you are likely to injure it, and the less you handle it the better will be the results.

I think that some of the troubles which have probably been the greatest in the packing house have been machinery that was put in

there, because the manufacturer had something to sell. It looked nice. It was a nice equipment to talk about, and the party to whom it was offered thought it was good to put it in. Primitive ways were the best. A few years ago—I don't know just how long—some shipments were made of fruit that was packed by growers in the fields up north, from near Auburn, I believe. It was packed in a crude way. It was shipped East in poorly loaded cars; and yet, all that fruit arrived without decay. It was all sound. It was a surprise to the Eastern agent of the California Fruit Growers' Exchange at that time, and he commented upon it. Now, the reason was that it went back to the primitive way. The men who did this were the owners of the fruit; they clipped it carefully; they handled it carefully; it was not bruised or brushed or hurt, and it went to the market sound.

There are some things that you can not dispense with in a packing house. A box-making machine should be in every well-equipped packing house. We, who live near the coast, need brushes. Some think you do not need them. That is a matter for each section to decide for itself, but when you do brush, I don't think the fruit should be brushed with hard bristle brushes, or, rather, with stubble or wood brushes, and it should not be brushed under heavy pressure. I think dusting the fruit, such as can be done and is now done with some of the better equipped and later brushes, will not hurt it. And I do not think that weight should be heavy. Wherever fruit is more than dusty, wherever the gathering on it be of dirt or smut and is heavy, I believe it will be well to wash it if it can be safely handled—better than by brushing it hard dry.

Now, in regard to the hopper, you have got to have that for your sizer. The hopper that Mr. Rumsey mentioned I think is the best that has been adopted. Have a soft rubber tube if you can, but, in the absence of that, your hopper should be of smooth garden hose, so you will have some give-way in dropping through. Care should be used in handling. Do not chuck the fruit in on the edges of the boxes. I think it would be better to have a very light springy substance to drop your fruit on. When it gets through the hopper, and runs over the brushes, there is only one thing to do, and that is to carry it on belts. Don't roll your fruit. Any kind of chute we have is likely to injure it. Fruit can be carried on belts a long way without injury.

The model packing house, in my judgment, should be built with a drop of a foot, two and a half feet, or three feet, just as is most desirable; and your receiving floor is on a higher basis. You carry your fruit from the brusher on belts, along your sorters, and bring it down to the level, where it goes over to the roller. You can hardly dispense with a roller or with a sizer of some kind. You must have something beyond the hand for sizing the fruit. I believe a sizer is now being made that handles the fruit quite carefully, dropping it upon spongy or loose canvas—not upon a hard surface. And this is an advantage. When that is done, you get it down to the packers, and there, you all know who have been in a packing house, that care is required. No packer can reach into a box of fruit and take it out indiscriminately with long finger nails without injuring the fruit. I think every one should wear gloves in a packing house.

The processes of packing fruit have been improved upon. The grader has been improved upon; and I think it should be so constructed that the fruit be brought together in a compass or place not larger than the box, and the pressure on the box in packing should not be enough to spring the box.

Now, take the brush, the sizer, the boxes and the press, and I think you have all the machinery that the packing house ought to have. I think everything else is waste. If I had a packing house, I would not have a place where the fruit could roll a foot. I would carry it on belts, and I believe it can be done.

You have got to have arrangements in your packing house for cooling your fruit. That is absolutely necessary. Whether you ship fruit under ventilation, or under refrigeration, I do not believe that the car is the proper place to cool it. I think you should have blowers. In your wash room have a blower to take the moisture off and cool your fruit. If you expect to ship it under refrigeration, have it in use. That is not a machine, and yet it is a part of the machinery. Fruit should be carried from the nailers into the pre-cooling rooms and into the car in the most careful manner. We have a packing house equipped at Pomona on the same style that Mr. Rumsey speaks of, with patent rollers. I think we have a good many hundred feet of them. All fruit is taken right from the press, and goes on to the gravity roller, and passes through the different spaces down under the floor, and goes into the pre-cooling room under the floor. In loading it out again, the reverse is the rule. We put fruit in the pre-cooling room and it goes down into the hallway, and it is there loaded into the vestibule of the car. When such an arrangement is made, it is an economy of labor. It is cheaper to run it over these patent ways than any other way, and less injury is done.

Now, in summing up, as I said before, you want a good, level-headed, common sense foreman, who will see these things and have them carried out. You want no machinery that you can dispense with. I believe, Mr. President, that is all I can say on this subject. (Applause.)

THE CITRUS PROTECTIVE LEAGUE.

By E. M. LYON, of Riverside.

I don't think there has been any organization formed since fruit packing was first started that is of more importance to the citrus industry than the Protective League. We have different organizations for packing and handling fruit, but each has its own particular ax to grind. The Protective League was organized, not for any one organization, not for any one packing house or for any one district, but for the entire industry.

When we were first organized, the first question that came up was that of freight. I speak of that to show what the league has accomplished already with a very crude organization, so to speak, and supported itself by only a small part of the industry; and if it was not for the exchange, which came *en masse* and has supported it most enthusiastically, we would not have had the proportion we have had of the industry, and we ought to have every one in the organization. (Ap-

plause.) The first question that came up was the question of freights. Of course we all wanted to get our fruit to market as cheaply as we could, and I don't think there are many of the packers who have not, at one time or another, approached the railroad with that end in view; and we never accomplished a single thing. We did at times get the promise of better service, but we didn't get the service. As far as the rates were concerned, we were simply pushed to one side. It was a question that they would hardly discuss with us. When we came to them and said we represented about eighty per cent of the citrus industry of Southern California we commanded attention, and you know the result.

A little over a year after the organization was formed, we obtained from the railroads a reduction of ten cents a hundred, which amounts to 7.2 cents for every box of oranges shipped out of Southern California, or any part of the State. That alone was worth more than the expenses of the league will probably be for a number of years—even what we have saved in a single year. The expenses have been very light. I think that about twenty cents a car a year has been all the assessment that has been levied so far for the expenses of the league.

The Executive Board, as they are called, have given their time for nothing. They have met their own expenses in attending the meetings, and they have done considerable work for the industry, and never have asked any compensation whatever.

Now, that is only one thing, and in connection with the reduction in freight, we obtained a positive promise from the heads of the railroads that we should have better time, better service, better equipment; and this year I think every packer will agree with me that we have had better service and better time than we have had for years. I am sure that we could not ask better treatment than we have had this year from the railroad companies.

Another thing that I think it has accomplished is to bring the growers or the packers and the railroad companies more in harmony. Now when, for instance, a number of different men went to the railroads, they kept taking up the time, and one man thought one thing and another another. Through the Protective League we went with a definite object in view, and we worked directly on that line, and that only; and that is one reason why I think we accomplished what we have in part.

Now, what is the aim of the league in the future? We are shipping now from Southern California alone nearly 30,000 cars of citrus fruit, bringing into the State over $15,000,000. Now, does not that represent enough value to stimulate all to work in harmony to accomplish something for the industry? Why, any business enterprise representing even a small proportion of that would be glad to spend a great deal of money to have everything pertaining to it looked after carefully. Just what will come before the league in the future is a question. We have got to feel our way in regard to the things that are important; but we do know that there are some things that we have to be in line on, so as to take care of them when they come up. One of these is the question of tariff. You all know how there has been a great deal of agitation in the papers in regard to revision of the tariff. When that time comes

there is no question but what there will be some who will want the tariff on citrus fruits. They will say that they want the fruits delivered cheaper, and if they throw open the markets of the world so that they can bring in Jamaica fruit, Mexican fruit, and fruit from other sections, without paying any tariff—they don't pay the taxes for the support of our Government; but if they can come in for nothing, why that will bring down the price of oranges.

Do we want the price of our citrus fruit brought down? Do we want these outsiders to come in and compete with us? We can't accomplish anything if we don't have organization. We are now trying not only to have the data for our own use, as to what the citrus industry really should have in the way of protection, but we are trying to get in line with all similar organizations—vegetable organizations, orange associations in the South, and, in fact, every organization that is agricultural in any way that needs protection, so that they will work in harmony with us, and help us to obtain what we think we should have.

Now, that requires a great deal of work, and the league has employed a secretary who is devoting a great deal of his time to that very thing to-day, and he can give you a great deal of data as to the response he is meeting from all over the country in this line. It has been a revelation to me to see how many associations there are throughout the country who are interested right in this line; and when the time comes, if there is some one to take the lead, they will fall in line and help us accomplish what we want.

Now, the question comes up naturally, How are we going to get every orange grower represented in this league? It costs some money to run it. We have run it very economically so far, and we intend to in the future. There is no money wasted; our entire expense to-day consists simply in the hire of a small office which we have in Los Angeles, the secretary, and a stenographer. Then, of course, there is the stationery and incidentals, but the entire expenses of the league to date have been very small—in fact, infinitesimal in comparison to what we have already accomplished.

Now, the only way we can get every one represented is by the packers coming into the association. We can't go to every single grower and ask him to join and pledge so much, because we want the thing exact so that every one will pay simply his share of the expenses; and we have thought the proper way, and the only way, to do that is by making an assessment of so much per car. Our assessments have been ten cents a car each time we have made them, and, as I said before, about two assessments in a year, and we may have to have three. What we want to ask of every one is to see that the organization that is shipping his fruit is a member of the league, that they will every one come in, so that we can have every one represented. The expense of carrying on this work will be very light. No one will feel it, and at the same time we will be in shape to accomplish a great deal of good for the citrus industry. (Applause.)

PRESIDENT JEFFREY. I now have the great pleasure of introducing Mr. C. C. Chapman, who will address the Convention further upon this subject.

ADDRESS OF MR. C. C. CHAPMAN.

Mr. Chairman: First, I want to thank Mr. Jeffrey for the thoughtfulness in giving a place on the programme to this part of our industry. I think it was very wise that the grower should be well informed on all branches of our very great industry. Mr. Lyon has told you something about the greatness of it, but I want to tell you it has grown so enormously, it has got so very big, that we must look to not only the horticultural end of it, but the business end as well. These very growers are too wise and long-headed to point their head always to the ground and look into the fertile soil, possibly to raise them up to admire their beautiful trees, without thinking of the marketing of this great product which they are growing. And therefore this Protective League comes in and attends to a large amount of absolutely important business which can not be done by the growers separately.

We remember how we used to meet before this organization was formed—some great question would come up, and the growers would be called together in an indiscriminate sort of way. We would meet and have a scrap over the question, and go away and accomplish nothing. You smile about it, because you know it is true. Some of the newcomers to California don't understand that. But we were going through a process of evolution, and I think we have crystallized a system by which the industry, as a whole, will be guarded as it could not possibly have been done under the old method.

Now, this league, we might say, is a non-partisan proposition. It does not belong to the exchange; it does not belong to the shippers; it just belongs to all of us. And right here I want to emphasize what Mr. Lyon said with reference to everybody being interested in it. If you are not a shipper, you can insist on the man who handles your fruit being interested in this league for your own protection, because, just as Mr. Lyon said, and we all realize, this tariff revision is going to be opened. A lot of fellows will never be satisfied until it is; and when it is, we have got to be right on the spot, well fortified to protect our citrus industry. (Applause.) And it is precisely like it was when we went to the presidents of the railroads.

Now, I make the assertion that this reduction which was obtained by this league could never have been obtained in the old-fashioned way. I know a great many of the growers said, "Why don't you fellows do something? Why did we elect you? You ain't doing anything." All the time we were working, and we got this reduction without ten people in Southern California knowing anything about it. But we were working. You had confidence in the men, and they were working, and they got it. But I want to tell you why. We had a secretary who compiled, collated, all the information. He brought it before the president. I remember Mr. Ripley said he didn't understand a good deal of this information, and if certain things were true, he would be very glad to look into it. Now, the league knew all about it, collated the information, selected the men to go to the president, did it all quietly, and the railroad didn't want to fight at all—although I do remember the remark Mr. Ripley made when we went in to interview him first. He sat back in his chair and said, "Well, I guess you gentlemen are in for another fight. We have just whipped you to a finish." That is just when he

had got the decision. "We have just whipped you to a finish, and I guess we can do it again, but if you want us to spend a lot of money we can do it." We didn't go there to fight, and in a little while he was bending over the table figuring and looking into the matter. Both he and Harriman gave careful consideration to it, which they would not have done by the old method. The railroad companies are recognizing this league, and they like to deal with the grower through it, and they will, and we will get more for the grower than you can ever get any other way.

I have a lot of information here which I will not attempt to read. It is very interesting, and it shows what our secretary is doing in coming in touch with the great agricultural products of the whole country. It is being done in self-defense. I refer to the uniform bill of lading. We must have such a thing as that, and we will never get it in any other way. We are going to get it now, however. Here is information which he has collated showing the enormous quantity of products which are imported into this country. It would amaze you if you had this, and this is being distributed by our secretary. We are trying to educate the people along those lines.

Without any further discussion, I am going to have the pleasure—and it is going to be mine, if you will pardon me—of introducing our secretary. Mr. Kendall, let me have the pleasure of introducing you to this audience—Mr. Kendall, our secretary.

ADDRESS OF MR. A. G. KENDALL.

Ladies and Gentlemen: I think Mr. Chapman made a serious mistake that he didn't continue what he intended to say, for I am sure he could say it much better than I can. It is rather hard to follow men like Messrs. Lyon and Chapman on matters of the Citrus Protective League, even if you are secretary and manager, because while I have been with them for about a year, they have been from its very inception, and either of them might say, like a historian of old, "All of which they saw and much of which they were."

I want to call attention to one thing in particular. It has been said that we are non-political. That is true. And yet, in entering into the citrus industry, there are some political features. We can say truthfully that it is immaterial to us whether we build two battleships or four, but we will all agree upon this proposition, that the people of this great country are standing with the President upon one of the other questions, and that is the control of railway companies through the Interstate Commerce Commission. Upon that there is no division. (Applause.) So it can be said truthfully that the Citrus Protective League, while non-political, generally stands for the principle that United States Senators should be chosen by the people, and that the Interstate Commerce Commission should have a general supervision over the rate question with the railroads of this country. So much that may be considered political.

Another question that came up a few months ago was our white fly scare. I want to refer to it briefly, because it arose soon after I became connected with the league. And this I do know, that through an organ-

ization which could truthfully say, as it could at that time, that it represented sixty-nine per cent of the citrus industry of the State, we did create an interest that enforced or assisted in the enforcement of a law by bringing public opinion to that end. The league has grown since then. We can now say that eighty per cent of the industry is represented by the Citrus Protective League, and that we are doing some good. (Applause.) I think the other twenty per cent ought to come in. (Applause.) Now, in connection with this white fly matter, I want to say further that they found this State without any available appropriation to eradicate that fly and control that territory. The State did the best it could with what moneys it had. It could whip around the stump and pay its bills for awhile; and finally, Mr. Jeffrey came down and he said: "I have got to stop. We have no money to pay our men who are watching the fields in Oroville and Marysville and Bakersfield, and we must keep up that control for a year at least." It was the greatest pleasure in my life to turn to the Executive Committee and agree that the Citrus Protective League would take up the vouchers. It is doing some good.

Now, a word about the tariff. We are not shouting tariff revision on the coast very much, although some of our newspapers are getting away on that subject, but it is possible that a little later they will have to consider that they are representing the people and the fruit growers of the coast. A few years ago we hoisted a free silver banner, and we found out afterwards we meant gold; and it is possible some of the newspapers in the State who are asking for tariff revision now would be puzzled to point out upon what product from California they want it revised.

In the past ten years or more, the manufactured products over the country have been centralizing, consolidating—trusts, if you please; but they limit their output, they cheapen their production, they are protected by patents and one thing and another. Possibly they can stand tariff revision. The Spanish war has been settled, Cuba has been made fit to live in, and Porto Rico has become ours. Millions and millions of dollars have gone into Cuba, Porto Rico, Bermuda, and the Islands, and these are to-day in direct competition with the American fruit grower, and twenty-four to forty-eight hours across the bay is their haul, while ours is 2,000 to 3,500 miles to get into our markets by railway.

Now, when you come to talk tariff revision to me, I am willing you should revise, but I say the fruit grower needs a revision with an upward tendency to meet those conditions, directly opposite from the manufactured product of the East. (Applause.) We can not consolidate, we can not limit the output; every grower of oranges here is in competition with his neighbor, whether he lives here or anywhere else. We have no patents to protect us. Here is the government of the United States, through its representatives, spending thousands of dollars every year for better methods, but you can not limit your output; you are all the time increasing it, and the only thing you can do is to protect yourself from the fellow who takes his money abroad to the Islands, Cuba, Porto Rico, or elsewhere—not Porto Rico particularly—and with labor conditions entirely different from ours, he comes in direct

competition with us. We must meet him with a tariff, and let the revision be upward.

Something has been said about the uniform bill of lading. Now, it is a fact that some four years ago the Interstate Commerce Commission took up the matter of a uniform bill of lading, appointed a commission composed of railway men and manufacturers from the East, and they made a report on a uniform bill of lading which in no way recognizes the perishable product; and realizing that there must be some good result from a uniform bill of lading, the International Apple Shippers, through Mr. Scholand and others, took up the matter and have filed with the Interstate Commerce Commission now, and it is pending there, a uniform bill of lading perishable. And I had information within the past two weeks to send out mailing matter to my mailing list—and I will tell you all about that in a moment, and I won't be but a moment about it—and I urged them to write the Interstate Commerce Commission in favor of the uniform bill of lading perishable, because it contains features as to claims filed, as to icing charges, and other matters that no provision whatever is made for in the bill of lading provided by the commission which I have spoken of. And I wish that every one whose attention has been called to it would show the Interstate Commerce Commission that he is interested in that bill, for the idea has gone out that possibly the people in the West don't care anything about it, because they have not been heard from. I think they will hear from some of them, because I am getting letters every day from Texas and Louisiana and Washington people who have written the Interstate Commerce Commission in favor of the uniform bill of lading perishable.

Now, just one more word about the tariff. The citrus industry is located largely in California, next in Florida, and is gradually creeping out through Texas and Arizona. As an industry itself it may be said to be represented by only three or four states. We have been receiving very favorable prices for the last two or three years. Other things have brought the question up to me as to how we could best get before the revision committee with our orange industry, and it occurred to me that we could take the produce growers—and let me tell you there are hundreds and hundreds of trucking associations all through the South and the Southwest; Texas has a hundred or more of them; Florida, Louisiana, Tennessee, Alabama, Arkansas, Missouri, they are all growing truck, not fruit particularly, but fruit and truck—and I started out then to get a mailing list of those people who ought to be interested; and let me tell you, above all of them, the produce growers should be interested; more, in fact, than the citrus fruit grower, because the produce growers have no tariff that amounts to anything as against Bermuda and the Islands. The result is that I have located a large number of fruit and trucking associations and prominent growers scattered in the places where I thought they would do the most good—that is, in the South and Southwest. Those people down there, many of them, are living on a tradition. That tradition was cotton and corn and free trade years ago, but they are getting that out of their heads, and you would be surprised, ladies and gentlemen, to see how many letters I am receiving from all over the South and Southwest saying, "We are in sympathy with you; tell us what we can do." So I think

that when the next election comes around and the political fellow comes along asking for votes, he will be asked a whole lot of questions down there. I know how the people of California stand—there is no question about that: but down in that section, where they have been bred and raised under a different theory, you have got to show them their own interest. I have been trying to do it. I have told them that in five years over $105,000,000 worth of fruit had been brought in, over $50,000,000 of it free of any duty, and in five years $26,000,000 worth of vegetables brought in. Cuba, Bermuda, and other places beat our own people out in the markets of the East.

Now, that is work that we are engaged in. That is the work that is taking ten cents a carload for your citrus fruit twice a year—possibly three times. At an expense of a little over $4,000 a year we have been running the league. Mr. Lyon said the saving on the orange rate would pay the expenses a good many years. It would for a hundred years, if you stop to think—over $700,000 saving in freight by the ten-cent reduction. Did you ever think of it? It doesn't amount to a good cigar, the assessment you pay on your carload of oranges, and I think we are doing you some good. I thank you.

(At this time an adjournment was taken until 1:45 o'clock P. M.)

AFTERNOON SESSION—SECOND DAY.

WEDNESDAY, April 29, 1908.

PRESIDENT JEFFREY. Mr. Teague, who is first on the programme, does not seem to be here, and if there is any other business that you desire to take up now, it will be in order.

A MEMBER. Mr. Chairman, some of us can not be at the lecture to-morrow night, and we would like to ask something about the white fly and its extermination. I would like to ask a question, Do you think it is possible to exterminate the white fly in any given locality?

PRESIDENT JEFFREY. I will just tell you in a minute or a minute and a half, while we are waiting, that at Bakersfield where there were about 100 or 125 trees infected, where we use fumigation, we are now unable to find any trace whatever of the fly. At Oroville, which will be described to-morrow night in very graphic terms, we are unable to find a single evidence of larva or eggs or any other form of the white fly. At Marysville, where the campaign was begun at the most unauspicious time, we have three men at work, and every two or three days, on an average, they find a larva. No one could find a larva there in a week, if not thoroughly acquainted with the ground. When there are three men putting in eight hours a day systematically on a block of trees, which have only small tops, you may know that it is very nearly

exterminated there. Possibly it is exterminated. We are going to watch those places for a whole year without any let-up at all. We are not afraid of its breaking out at Oroville or Bakersfield. At Marysville we may have to treat it again. The only trouble about the white fly is in the cities. There is where the devastation occurs. If it should break out in Redlands or Riverside or Los Angeles, you would lose half the adornment of your yards and gardens, just as you will see to-morrow night from those pictures. I am very sorry you can't be here to-morrow night and hear the lecture.

Mr. Teague has not come yet, and we will now listen to Prof. Ralph E. Smith on "Health and Disease in the Citrus Tree."

HEALTH AND DISEASE IN THE CITRUS TREE.

By PROF. RALPH E. SMITH, of Whittier.

Ladies and Gentlemen: Being asked to speak on the subject of citrus tree diseases, I have chosen the topic as put on the programme somewhat purposely in a rather indefinite manner, making the subject "Health and Disease in the Citrus Tree," and not wording it "Citrus Diseases, or Disease of Citrus Trees," or anything of that nature. My idea in that was this, that the subject of citrus tree diseases is one of peculiar indefiniteness or complexity; in other words, it is impossible to give a satisfactory and a complete expression on the subject of citrus tree diseases and classify those diseases, and describe each one minutely, and in a clear way tell how to remedy it. That would be impossible under California conditions, and under the conditions of the California citrus business. If I was speaking in New York state or other regions in the East, perhaps on apple tree diseases or diseases of the peach, or something of that sort, it would be a very simple matter to take up almost all the serious troubles of a tree of that sort and classify them and describe them, and tell what they were and what the cause was, and the remedy so far as known, and present the subject in a satisfactory manner so that each one who listened, if I was competent to speak on the subject, would feel that I had described conditions as he had seen them, and that I covered the case in his particular instance, and that the subject had been thoroughly presented. But the subject of citrus tree diseases in California is very different from one of that nature. The subject is, in its very nature, complicated and indefinite. It is indefinite, because it is complicated on account of the conditions under which citrus trees grow here, and the nature of the tree itself. So I will make that preface to what I have to say, that the subject is of this nature, as I will treat it, and I will not attempt to give a cut and dried classification of the cause, nature, and effect and remedy of the diseases or troubles of the citrus tree.

To define health and disease, particularly as applied to cultivated plants, is by no means easy. While we all have a general idea of the conditions indicated by these terms, and conceive of the two as opposed to one another, one being that which the other is not, yet a definition of each and a sharp drawing of the line between them is quite difficult. In the case of commercial crops, and even more especially with citrus fruits, it is often true that the condition of the plant, or the nature of

its product most desired for commercial ends, may not be synonymous at all with the normal, natural development which we ordinarily regard as health. On the other hand, an unproductive condition or the development of undesirable qualities, may be most disastrous commercially, and yet not indicate a condition of disease or anything abnormal in the natural development of the plant. In other words, the perfection of desirable commercial qualities is by no means the same as perfect, normal, natural development or natural health. The fact is, that the work of the plant pathologist in California, particularly in the case of citrus fruits, is not limited to the study of actual disease, and the means of avoiding it. He is rather called upon to advance commercial perfection, and learn how to overcome conditions which are undesirable from this standpoint, whether they be ones of actual disease or not.

Disease in the ordinary sense is the effect of some cause or condition which interferes seriously with the normal functions of organic life. We commonly understand such a condition as one of a somewhat more complicated nature than that resulting from a simple injury. The causes of plant disease are many. Most important, ordinarily, or at any rate most easily accounted for, are those which are caused by the action of what we call parasites. Parasites are living organisms, either of an animal or vegetable nature, which live at the expense of other individuals, usually growing closely associated with their tissues and drawing nourishment from them. The plant pathologist does not ordinarily undertake to investigate cases of parasitic injury caused by insects, as the subject of entomology has become a large and important one. Plant pathology is, in the usual sense, the study of all diseases or troubles with plants other than those caused by insects. The parasites with which the plant pathologist has to deal are mostly of a vegetable nature, and are largely of the class known as fungi. The fungi are real plants of a low order of development, many of which are parasites to a greater or less extent upon other plants. A great majority of our best known plant diseases are caused by fungi, such as the rusts, smuts, mildews, and many blights, rots, etc., from which very few of our commercial crops are free. A number of other plant diseases are caused by bacteria, organisms of a still lower class, forms of which are responsible for most of the serious animal diseases, but of which only a comparative few affect plants. Some of the most distinct bacterial plant diseases are the pear blight and walnut blight, both well known in California.

Aside from the troubles caused by parasites it is well known that plants are affected in most various manners by influences resulting from the conditions under which they grow. Vegetable life is dependent upon certain indispensable factors, which, acting in the proper degree, contribute to the normal development of plants. These factors may also vary to a considerable extent without seriously affecting the life or condition of the plant, but beyond certain limits their influence results in injury, or may go still farther and bring about a condition which may be classed as a disease. The factors to which we refer are those upon which all plant life depends, namely, moisture, temperature, light, chemical food elements, and freedom from other influences which might cause injury. In regard to these different

factors, their general influence upon plant life is well known. We are all aware, for instance, that water is indispensable, but that either too much or too little is injurious. Also that the same is true in regard to sunlight, heat, cold, and chemical food elements. While an excess of any of these factors may produce a very evident injurious effect on the plant, scarcely different from a mechanical injury, yet, when relative conditions in regard to these essential factors become complicated, we may and often do get results upon plants which are strictly of the nature of disease with definite symptoms, in which it is very difficult to establish definitely a simple succession of cause and effect.

We must further consider the fact brought out at the beginning of this paper, that simply a condition of natural health is not sufficient to satisfy commercial requirements, but that certain definite standards are set up of quality and quantity of the product, some of which may be radically different from those which Nature, so to speak, intended. From this standpoint, the control of the effect of natural conditions upon cultivated plants may be of even greater importance in relation to these more or less artificial qualities than as simply affecting ordinary health. Horticultural conditions in California are of such a nature as to make this phase of the subject of particular importance. Our crops are grown largely under conditions which are entirely artificial, the plants themselves being natives of other portions of the world, and grown here in places where the conditions which Nature ordinarily supplies are largely under the control of man. Two factors particularly, those of irrigation and fertilization, are of the greatest importance in this connection. In the citrus industry we plant a tree in a place where it would perish almost immediately without constant attention, and have at our disposal to withhold or supply, in any desired amount, two of the most important factors in plant growth, water and soil food. The amount to be supplied, the time of application, frequency, and many other most important considerations are very largely in the hands of the grower, and the growth of the tree, its health, life, and development, as well as the quality and quantity of its fruit, depend almost entirely upon the manner in which the grower handles these controllable factors.

It is further to be said that there is no tree more sensitive or easily affected by conditions of this sort than the orange or lemon.

To come more directly to the subject which we are expected to discuss, we may say, in general, that in our investigations of the diseases of citrus trees in California we have found almost nothing which may be ascribed to the effects of any parasite; that is to say, we know of no important citrus disease which is caused by any fungus or bacterial organism, or anything of that nature. If we except decay of the fruit and a very few exceptional cases of disease of the tree, the above statement may be made an absolute one. It is true beyond all question that our most serious troubles with citrus trees in California are the effects upon the tree of unfavorable natural conditions, and not those of active parasites. Some of these effects, it must be confessed, are at present most obscure and difficult or impossible to account for in any satisfactory manner. Yet the study of the various diseases, and of the nature of the tree itself, has been sufficient to show that this is true.

In connection with the effect of natural conditions, such as temperature, moisture, food elements, etc., upon the growth of plants, two peculiarities of the citrus tree may be mentioned here. The first relates to its manner of growth. Most of our ordinary fruit trees are deciduous. Their life each year is marked by a period of growth during the summer and a period of rest during the winter. In their woody stems and branches the substance formed each year takes the form of an annual ring, the number of which corresponds very closely to the age of the tree. These rings are visible on account of a difference in the structure of the wood formed in the spring and during the summer. At the beginning of each growing season, large amounts of sap circulate in the tree, and the first wood which forms at this time has a very coarse, porous structure, being composed of comparatively large open vessels, which are mechanically adapted to conducting the large amounts of sap which are flowing at this time. As the season advances the woody growth in thickness becomes less, the amount of sap diminishes, and the wood now formed has a closer, denser structure with much smaller vessels, until finally, toward the end of the summer, growth ceases altogether. The next spring another porous coarse layer is formed outside the fine-grained wood of the previous fall, and from this difference in structure the annual rings are visible to the eye. The difference is also of importance, as just pointed out, from physiological reasons, the coarse-grained spring wood allowing the passage of the large amounts of sap which are flowing in the tree at that season.

In the citrus tree a number of growths take place each year. Each of these is marked by a definite ring of wood in the stem and branches, so that if the tree makes five growths during the season, five rings will be found in the wood for that year. The fact pointed out above, that the structure of the wood is of great importance as permitting or obstructing the flow of sap, is the vital one in this connection. Citrus growth, while having a certain normal regularity under uniform conditions, responds in a very marked degree to the treatment which is given the tree, particularly that in respect to moisture. Growth naturally follows an abundant water supply and *vice versa*. If, then, the water supply should be extremely irregular, disastrous results may follow from this peculiarity in the growth of the tree. During a period of dryness, the woody tissue which serves as a channel for conducting the sap becomes dense, fine-grained, and of poor conducting quality. If the tree is then suddenly supplied with a large amount of water, its trunk and branches are not able to conduct that which is sent up from the roots, and complications may result. Further than this, the citrus tree is one in which the flow of sap from the roots is extremely free and abundant. One needs but to cut off the top of a vigorous orange or lemon tree, and then supply the root abundantly with water, to discover the remarkable freedom and promptness with which the excessive amount of water is sent up by the root into the trunk.

The second peculiarity of the citrus tree alluded to above is one which it shares with the cherry, peach, apricot, and other stone fruits, and a few other plants. This is a tendency to form and exude masses of a gummy substance as the result of injury, or even from unfavorable natural conditions. The gumming is due to complicated physiological

process in the tree, and occurs in the trees mentioned, often very profusely, from a great variety of causes. It may be due to mechanical injury, to the effects of fungi, as seen for instance in the peach blight, or simply to physiological derangements in the tree. The gumming disease may be likened to a form of indigestion, or in some degree to the abnormal activity of the mucous membranes seen in a person suffering from a cold.

In taking up now in detail some of the more prominent diseases to which citrus trees are subject in California, we would not be understood as maintaining that they may be all easily explained as due to easily seen effects or evident causes, or that they may be easily remedied by simple rules of irrigation, cultivation, or fertilization. We mean rather to simply express a belief that these troubles are of the nature described, even though complicated and obscure and difficult of treatment in many cases.

Under the general term of gum disease are included several troubles of a more or less distinct nature. Of these may be mentioned particularly the gum disease of the lemon, the scaly bark of the orange, and the true gummosis, or Mal di Goma of Europe and Florida. The last mentioned disease is quite distinct from the most common forms of gum disease which occur in California. It is characteristically a disease of the root rather than of the trunk, and may be described as a root rot, more than a simple gumming. We have seen this trouble only in a very few instances in California. It affects the tree mostly from the surface of the ground downward, and shows itself, as a softening and decay of the bark, finally affecting the whole root. So far as seen here, it appears to be due to an excessive amount of moisture about the trunk, particularly when accompanied by banking of the earth closely around the tree above the normal height.

The gum disease of the lemon manifests itself as a breaking out of gum on the trunk, usually between the point of budding and the main forks of the tree. This disease has been much discussed of late in the horticultural press and elsewhere, and the conditions which produce it are quite generally understood. It is without question entirely physiological, and not brought about or concerned in any manner with any fungi, bacteria, or other parasites. It occurs almost always in heavy ground, in places where moisture is too abundant, and particularly where the soil has become compact about the trunk above the point of budding. Instances are practically unknown of lemon trees being affected, save under conditions of this sort. The lemon gum disease may be avoided in no other manner than by avoiding these conditions which bring it about, or when once started may be remedied in no other manner than by improving said conditions. This may be done very largely by cultural means, consisting of loosening the soil thoroughly about the trees, uncovering roots which are too deeply buried, avoiding saturation of the soil close about the tree, and, if feasible, replacing the heavy soil with sand or gravel in a circle about the tree. If planting in soil which is manifestly liable to the disease, two things are strongly advisable. First, the use of the bitter orange or so-called Florida sour stock for a root; the second, the practice of high budding, working the tree about fifteen inches from the ground. In the case of trees already affected, it is often advisable to remove the bark which has become

separated from the wood and killed by the exudation of gum, in order to give an opportunity for new bark to form, and the wound to heal over. This treatment is in no sense a remedy for the disease, but simply a method of wound treatment, as might be applied in the case of any injury. All bark which is badly affected should be stripped cleanly from the tree, trimming neatly about the edges of the sound bark, and the exposed wood should then be covered with some material for which a wax, composed of four parts resin, one part beeswax, and one part raw linseed oil, boiled together and applied as a liquid with a brush, is as good as anything. It is also advised to slit the bark of affected trees up and down the trunk in several places. Orange trees are sometimes affected in very wet ground.

The scaly bark of the orange is of a nature much less easily explained. The manner of its occurrence, affecting the trees here and there about the orchard, makes it difficult to understand how it can result from conditions which seem practically alike all over the orchard. The disease is limited to the sweet orange, not affecting the lemon, grape fruit, or other species, and is much more common on seedlings and navels than on the Valencia. It manifests itself as a scabby, gummy breaking out at any point on the trunk or branches, and usually keeps spreading about the trunk or along the branch from year to year. We can only say, in regard to the nature of this disease, that the condition of the affected tissues when studied with the microscope is similar to that in the lemon gum disease. There is the same breaking out of gum through the bark, with the difference that in this case it is less abundant and active, and takes the form of a mild irritation, which keeps the affected area continually spreading at a limited rate. In our opinion, the disease is connected with an irregularity in the flow of sap up into the tree, starting primarily in an irregular water supply to the roots, the trouble resulting from interference with the flow of sap on account of the structure of the wood, as has been previously mentioned. We feel quite well satisfied that the disease starts as a result of an abnormal relation between the flow of sap and the structure of the wood, which should conduct it, however obscure may be the cause which first brings this about. We have seen cases of successful treatment of scaly bark areas on orange trees, when not too large, by cutting out all the affected part and covering the wound with the wax described above. In doing this, it is necessary to cut away all bark which shows discoloration between it and the wood, beyond the portion where the surface shows the scaly condition. This is found particularly just above the visibly affected portions. The practice of covering portions of trees affected with scaly bark with a thick paste composed of lime and sulphur is sometimes resorted to. We have not been able to observe any very decided or permanent benefit from this treatment.

Florida die-back, or exanthema, is another disease which may be included in this class, and occurs to some extent in Southern California. This is a disease of very pronounced symptoms, both on the fruit and twigs. It affects particularly the orange. The affected oranges show dark brown discolored patches on the side, and from these places the fruit often splits. The oranges have a characteristic pale yellowish-green color, and are quite sweet when not more than half grown. The branches die back from the tips, send out clusters of small shoots from

the twigs, and the bark of the latter breaks out in corky protuberances or pustules. More or less gumming is associated with the latter. This disease is described in Florida as being due to an excess of organic nitrogen in the soil. That this is not entirely the case, but rather that its cause is more complicated than this, is shown by the appearance of the trouble in this State, where it is limited almost entirely to a certain type of soil. This is the coarse, granitic, very porous soil, which is found particularly along the base of the mountains in various places between Highlands and Pasadena. On such soils the Florida die-back is of quite frequent occurrence. There have been a very few cases of the disease on heavier soils where the Florida experience seems to hold true, all the instances on such soils of which we are aware having been associated with very heavy applications of fertilizers rich in organic nitrogen. In the case of the type of soil mentioned, however, the disease occurs very severely in many instances where only moderate amounts of fertilizers have been applied. The most pronounced quality of this soil is the free passage which it affords to water. It becomes very wet during irrigation, but unless water is applied very thoroughly and carefully and quite frequently, the upper soil becomes absolutely dry between irrigations. This soil also takes up water very poorly in a lateral direction, so that the space between the trees and much of the whole body of soil becomes extremely dry in many orchards. The disease appears to be brought about in some manner through an irregular food supply, resulting from the irregular water supply which trees get in this soil, unless irrigation is particularly well carried out. With trees which are not well fertilized, the effect is simply one of ordinary die-back. True exanthema seems to result where the soil is of the type described, and a fair amount of fertilizing material has been applied. It is apparently a sort of indigestion in the tree, more food being taken up during irrigation than the tree can take care of after it gets into the condition of dryness which follows. On heavier soils the same thing occurs only where very excessive amounts of nitrogen have been applied.

Cases of ordinary die-back, failure to grow, poor development, mottled leaf, poor production, barrenness, etc., are of very frequent occurrence, but can not be ascribed to any one cause or considered as representing any special form of disease. These conditions result in a great majority of cases from failure of good cultural methods or unfavorable conditions in the location of the orchard.

With the orange, the fruit itself is affected by two very characteristic troubles, both apparently due to irregularities or abnormal conditions in the development of the fruit, from causes which can not be fully explained. We refer to the puffing and splitting of the fruit. We can give no information of definite value as to the exact nature or means of control of these troubles.

In regard to the treatment or means of avoiding the various diseases which have thus far been mentioned we can give no absolute rules to fit all cases; but, in this connection, the following remarks by Mr. C. C. Chapman, at the Citrus Convention held in Riverside in January, 1907, are very suggestive: "There are certain general conditions which I believe are applicable to all of Southern California. First, I think it is an essential requirement that you should keep your grove absolutely

in an even condition; never have it call for anything; never have it need irrigation; never have it need fertilization; never have it need anything, so far as indications are concerned. That is, you don't want a grove to show you that it needs anything. You don't want it to arrive at that condition where it will show this." We can give no better advice than to emphasize what Mr. Chapman has said as to the importance of maintaining a uniform, even condition and growth of the citrus tree, avoiding all extremes and sudden changes which would tend to produce irregular development. Whatever may be the exact nature and cause of these obscure troubles, it is certain that they all have their origin in irregularities of growth, or functions as influenced by natural conditions, or the treatment which the tree receives. The peculiar sensitiveness of citrus trees to the effects of such conditions makes it particularly important that their vital processes be kept in a uniform condition, free from violent shocks. So far as climatic influences are concerned, this can not be entirely accomplished, but in his manner of soil treatment as related to irrigation, cultivation, and fertilization, the grower should study each peculiar type of soil most carefully, endeavoring to maintain the most uniform possible condition as to water and food supply.

These troubles being of a physiological or autogenous nature, rather than the effects of parasitic organisms, any application to the tree of the nature of a fungicide or insecticide is ordinarily out of the question. In the case of the Florida die-back, beneficial results have been claimed from spraying with the Bordeaux mixture, in which case it is possible that the application of this substance to the foliage has had some physiological effect.

Brown spot, which has been so much in evidence during the past season, is another trouble affecting the orange fruit. In regard to this we can only say that it consists in a dying of the rind of the orange in certain spots, drying out and turning brown. What causes the rind to die in this manner can not at present be explained. Troubles of a somewhat similar sort are found in the lemon, though fortunately they are not of extensive occurrence. Of the fungous and parasite troubles which affect our citrus fruits we have, as has already been stated, very few, except those which cause the decay of the fruit. Apparently the one fungous disease affecting the citrus tree at all in California is a root rot, which occasionally occurs in citrus orchards, though more commonly in those of deciduous fruits. This disease is commonly found on land which has been cleared from a growth of oak trees, a situation which is not common in the citrus districts. The trouble consists in a rotting of the roots of the tree caused by toadstool fungi, which propagate on the decaying oak roots in the soil. We have known of one instance of this trouble occurring on orange trees. Of fungi causing decay of the fruit, we have a considerable variety.

The blue-mould fungus causes the ordinary form of citrus decay. There are two different species of this mould quite common in California, the more usual of which, the olive green form, is *Penicillium oilaceum*, while the bright blue form, which is less common, is *Penicillium italicum*.

The brown rot of the lemon, one of the most active forms of citrus

decay, is caused by a fungus which has been named *Pythiacystis citrophthora.*

Another very virulent form of lemon decay, which fortunately is not of very common occurrence, is that caused by a species of *Sclerotinia.* This fungus produces an abundant growth of white mould resembling a mass of cotton, which grows over the lemons in storage very rapidly.

During the past season a large amount of decay of navel oranges has been caused by the so-called "black rot" or navel end rot. This is not a new occurrence, but was more abundant than usual early in the past season. It is caused by a black mould fungus (*alternaria*) which is not an active parasite, but infects navel oranges to some extent when moisture is abundant.

PRESIDENT JEFFREY. The subject will now be discussed by Mr. V. V. Leroy, of Claremont.

MR. LEROY. As Professor Smith has well said, one of our great troubles in the diseases that affect the orange or lemon, or citrus trees, is the vast difference in the conditions which we are confronting. All over this part of the country there are so many different kinds of soil, different conditions of climate, that it does make a vast difference in our treatment of things as to what kind of soil we have or as to the climatic conditions. For that reason, when I was asked to take this subject, I thought right away that the best way to get at some practical points was to get a few of the most intelligent men I could from the different sections representing this part of the world, and for that reason I have written or spoken to a number of people scattered all over Southern California, who will in turn take up some phase of this subject of disease of the orange tree, and there are some remedies, of course, that they may propose; and after that, if there is any more time, I might say a word or two as to the experience I have had. I will first call on Mr. Koethen, of Riverside, who, in some respects, I think, has had as much experience as any one on this trouble.

MR. KOETHEN. Mr. Chairman, Ladies and Gentlemen: Mr. Leroy asked me to express my convictions concerning the characteristic features of scaly bark disease. I am fully convinced that there is a very strong distinction between the scaly bark disease and any other disease that affects our orange trees. The characteristics are marked, and the very fact that most of the others can be cured, and the scaly bark disease can not be cured, as far as we know, places it in an entirely different class. If you will cross-section a limb affected with scaly bark gum disease, you will find that the disease enters clear through the wood—clear through the hard wood. I don't believe that is the case with these other more superficial diseases, and although I rather hesitate to differ from the opinion of so distinguished a man as Mr. Smith, I would call it a much more virulent form of disease than that of the lemon—much more virulent for the reason that we can not cure it; and I do hope Mr. Smith will take up this question from the standpoint of a scientist and study it, as we have been compelled to do, practically, in our orchards. I don't think it is safe for us to assume that it is not contagious. It may not be, but I do believe that we ought to treat it at present as though it were contagious.

MR. LEROY. I knew Mr. Koethen had some ideas a little different from Professor Smith on the subject of the contagiousness of this disease, and that is one of the reasons why I wanted to have him express himself. There seems to be some reason to judge that it is contagious. In my own case, I never thought it was, because of the conditions in my own grove; but, as he said, it may be. We had better study along both lines. We have also with us Mr. Kennard of Glendora, who has an entirely different class of soil from that which Mr. Koethen deals with, and I would like to hear from him on both the remedies and his experience along these lines.

MR. KENNARD. My experience with the gum disease is confined almost exclusively to this foot-rot. I have only one or two trees that are troubled to amount to anything with the scaly bark disease. Some years ago I found one orchard in particular that was badly infested with this gum disease at the root. I treated it with carbolic acid, and in my case, with very marked success. Across the road, in another orchard, I found gum disease in one row, and in about six trees in another row. The strange part of it is, on all of those trees where I found the gum disease, I found it was on a lime root. I don't know that I have found on my soil a case of gum disease on anything but a lime root, so that the root, I think, is a very important matter in regard to fighting this gum disease. I have seen this gum disease treated on lighter soil, and also on heavier soil, very effectively by the carbolic acid treatment.

MR. LEROY. We have also with us Professor Paine, from Crafton or Redlands district, and he has another kind of soil up there, and has had probably as much experience or longer experience than any other citrus grower on the whole, and he will give us his experience along the line of diseases of the lemon.

PROFESSOR PAINE. Ladies and Gentlemen: I want to confess that my experience has not given me much that I can give to you. I have been making some observations of what gum disease is, but I think I have done more experimenting how to cure it than I have in studying what it is. Originally, I conceived it to be an infectious disease, and I treated it with carbolic acid; and then, because I found a hardening of the bark there, and because I thought that the bark had its office in respiration, and that that was hindered by the hardening of the bark, I gave it a chance to make new bark, and after applying the carbolic acid I used a thing that probably is not at all proper to use on a tree—I used neat's-foot oil, because I knew it used to soften my shoe leather, and I thought it might soften the bark. But the tree to-day that I applied these things on is vastly improved from its original condition. One limb was in an almost dead condition. Its oranges were hardly larger than the large marbles children sometimes play with, and they were very inferior in quality. The leaves were scarcely larger than the little finger, and very small in number. I concluded to keep on experimenting with that particular tree because it was nearly dead, and because I would not lose much by its loss. That is the tree to which I applied the carbolic acid and the neat's-foot oil. In the earlier days I used common beeswax. I think that the Scotch wax, which is prepared

by Dr. Woodbridge, makes a very good covering. Any grafting wax will do the same. Now, the condition of that tree is this, that the oranges have become as good as any on the neighboring trees. I really wish I knew what caused it. I told you I would tell about my experiments more than my knowledge. The bark was removed on account of the covering of wax which I gave it. As the cambium came down and reformed, it was renewed along, and it seemed to improve from that time on. I have almost cured that, but not quite, because there are exudations and stains from that bark in the outside of the wound, as if the disease were going on. Those are the conditions that Professor Smith speaks of. I agree with him that the conditions should be uniform, but where you and I and all of us water our trees quite regularly, cultivate them in about the same way year after year and month after month, and fertilize them in a regular way, we hardly know what change to make. This year I made a change in some work that I did to my trees. There were a great many weeds under the trees, and I hired a gang of men not to cut weeds, but to loosen the earth close to every tree I had in my orchard. I don't know whether any good is coming from it, but I don't think any harm is coming. I had a boss man to see that they didn't dig the tree more than they did the earth. I have had very little of that gum disease at the base of the tree, but I had the idea that possibly the respiration of that tree was affected by the crowding of the bark against the tree, and that that possibly comes from the growing outward of the tree against the soil. And although my soil is not a hard soil—it is a gravelly loam—I have trees that have been in there for thirty-one years, and I think the soil should be stirred up sometimes. I am going to clean the trunk of that part of the tree where that gummy exudation is and where the scale is. I don't think I am going to take the care I used to in removing the bark and anything that might be infectious. I used to spread a piece of gunny sack close around the tree, and everything I scraped off I would put in a tin box and carry it away and burn it. I have not studied it as Professor Smith has, with his apparatus, to determine the infection. I just guessed it might be so, and did that.

I have also done another thing. A tree doctor applied to two of my trees a preparation that he said would cure this disease, and if he didn't he would not ask for any pay. I thought I would take at the same time some of the coal tar we get at the gas works. I took some of that and covered the exposed part, not putting wax on that. This man came afterwards and saw his tree had exudations in it. He said, "I forgot to slit that tree up," and he did so, and since then I have not seen any exudations on his tree, nor on the tree that I treated with that coal tar. So, you see, while I have had some experience, I don't know much. I thank you for listening to me.

MR. LEROY. I would like to say I have had the same experience in my orchard as Professor Paine has had on the slitting process, which I obtained first from Mr. C. C. Teague. I don't know whether he was the originator of it or not, but I have used four or five of the different preparations like beeswax, carbolic acid, and tar. I have used all of those with practically the same results until I came to the slitting of the

bark. When I heard two years ago that that was what Mr. Teague did, I thought he was a good one to follow, so I slit the bark of the next trees I tried to doctor. It is about twenty months since then. I used beeswax to cover up the wound and keep the air out; and I have not seen a particle of gum exude from those trees since. I have come to the conclusion that the slitting was of very much more account than I at first considered it. I simply put the beeswax over to keep out the air.

We have also with us to-day Mr. J. W. Mills, who has been in experimental work for some fifteen years right around in our sections. I am sorry to say that he is going to leave us in a few months. I would like to hear from him on the subject of his experience in splits and drops, or anything he wishes to say in a few minutes on the subject of citrus diseases.

MR. J. W. MILLS. Mr. Chairman: When I talk about splits and drops, I wish I would get stage-struck so I could not talk. I don't think I will talk about that at all. There is a disease that has been spoken of that is quite common in certain sections, especially near the range of hills to the north of the valleys, and that is what they call the Florida die-back. I have brought a few samples of it here that come from an orchard of ten or twelve acres. This is a growth that was made last June. The tree was not affected until it came to a height of twelve or fifteen feet. These leaves will start to turn yellow or get crisp, and the touch of a finger will cause them to drop off. They will dry up, and the wind will shake them off. There is an exudation of gum clear down to the green wood. Some people claim that it is due to infertility, and a good fertilizer will correct it. There was a case over in Pomona where there were about seven acres that were affected in the center of a hundred-acre orchard. The trees became badly affected in the second year. Occasionally an orange would be found on them that would be exuding the sweat that would have this peculiar brown gum on it, and would crack at those places. The trees in that orchard were planted east and west from the nursery. We came to a certain point in the orchard where it stopped almost like a wall. The trees of the orchard were normal size, and produced good crops. In the other direction it kept getting less and less until it died out. This orchard was bounded on the north by a lemon orchard which was affected in the same way. The owners of this grove fertilized heavily with barnyard manure on that seven acres and worked it in. They had their own water system, and irrigated it whenever they thought the trees needed it. Still, after the spring growth had passed, they would die back in that way. So they tried commercial fertilizers in connection with barnyard manure. They tried nitrate of soda, and the same results were obtained. There is a man over at Highlands who claims to have found a remedy for this, and claims to have gotten it from the authorities at Washington. He claims he sprayed his trees (some that he didn't know whether he would dig out or not) with a weak solution of Bordeaux mixture when the fruit was about the size of peas, and again about six weeks later, and his trees are now as fine as any he has. That is what he tells and his neighbors tell about it. There is an orchard adjoining where they will spray this year about 100 acres that are affected the same way. He used Bor-

deaux mixture, but instead of using 4-4-40, used 4-4-80. What virtue there is in that remains to be seen from future developments.

The man who is doing that is going out into orchards that are affected, and he agrees to do the work for nothing if you will give him half the increase of the crop. He has taken a few orchards that way, and I visited one of the owners the other day, and he said his crop had doubled since the treatment commenced. He is using, in conjunction with barnyard manure, commercial fertilizer, and the increase he gets may be due to that, so that is no sure evidence.

Mr. Leroy wants me to tell about an orchard that had a very bad case of puffing in it over at Pomona. A man has thirty acres of orchard, and right through the center of it has a gravel streak with cobblestones mostly, and his trees in that part of the orchard dry out in about two weeks after irrigation. He only irrigates once in thirty days. I have seen these trees with the leaves all curled. They looked as though they never would recover. However, they held the fruit, and when picking time came there were about sixty per cent of the oranges on those trees that were puffed and cracked—some cracked lengthwise and at all sorts of angles. That looked like a good evidence of irregular conditions.

MR. LEROY. I will not take up much more of your time. We only have one more gentleman to speak. He needs no introduction to you. You all know Mr. Bishop, of Orange.

MR. BISHOP. The orchard with which I have had experience was planted or budded in 1876—that is, the orange trees. The lemon trees are of a later date. I have considered for a long time myself that the gum disease was a constitutional condition, and not an infectious disease. I can show you scaly bark on the orange tree on all kinds of soil from black adobe to light sand. I can show the gum disease of the lemon on all kinds of soil, without an exception. If you find the disease in a lemon tree before it has advanced very far you can cure it, or stop it for a considerable time by cutting it out, as you would an ulcer. You can do the same with scaly bark if you find it early enough. In a big seedling orchard where a tree is badly affected with scaly bark, you take the tree up and plant a new one, and the young tree will have a hard time to get a start. So we are trying these experiments after having dug up some trees and having found a magnificent root system with a hole nearly large enough to bury a horse. By sawing that tree off with a crosscut saw low enough down so that there was no dark center, the new sprouts from that would make a good tree, it would make a good budded tree. We are trying that experiment now upon about fifteen trees. But if the disease is old enough so that the wood is dark at the grain, you might as well take it out and start anew. I have dug up a ten-acre lemon orchard in the last two years that was absolutely ruined by gum disease before we had sense enough to do anything for it. Now, I am planting it anew. I don't know that it would be of any advantage to say I am planting it with bitter Seville orange trees, budded twelve to twenty inches above the surface of the ground. That is the condition in which the orchard is being planted.

MR. LEROY. As I obtained my information from Mr. Teague, I am going to ask him a question as to splitting the bark. Can you state how long ago it was you commenced that method, and what results you have had?

MR. TEAGUE. First, I would like to disclaim any credit of being the originator of that method. I am not. I don't know who I got it from. I got it at one of the horticultural meetings. Some one told me he had gotten the best results by splitting the bark, cleaning away all the wood, doing nothing, digging around the crown, and applying nothing whatever. That is the method we have followed ever since with very good results. In our case it has been very effective. We began that treatment, I think, about five or six years ago.

MR. LEROY. What are the results?

MR. TEAGUE. The results have been excellent wherever we have taken in time. We have cured hundreds and hundreds of lemons.

MR. LEROY. Mine was entirely on oranges, but Mr. Koethen thinks it is not curable. I am waiting with a little impatience to see how mine is coming out.

MR. TEAGUE. There has been gum disease in a good many of those that have been treated, but they are now apparently healthy.

MR. LEROY. What is your soil, Mr. Teague?

MR. TEAGUE. It varies. It is of a loamy character. It varies from sandy soil to heavy ground. Our trouble has been entirely upon that portion of the ground where the grade of the land was so slight that the trees didn't receive proper drainage; and as soon as we found that out we removed the cause, and we had no trouble after that.

MR. LEROY. I think you will all realize from this discussion that we ought to be very grateful that we have a pathological station that we can send these questions to that we know nothing about, and have them study it up. We have not a chance or the time, and I am very glad that Professor Smith has that work in charge. The great problem is that we have these troubles right in the center of our groves that receive exactly the same care that perfectly healthy trees have. My trouble is right in the center of the grove, and the trees get exactly the same treatment; and as near as we can make out, all the conditions are alike, and yet this condition exists. That is the great trouble. If Professor Smith can find out those things for us, I think we will all be very glad of it. I am very much obliged to you for your attention. I thank you.

MR. HOLMES. I think Professor Smith is on the right line. I have found whitewash was just as good as anything else, and the best thing to apply is to take the soil away from the trees. It is the improper con-

dition of the soil that causes the trouble. There are two trees with us which have been diseased for twenty years, and they are no worse than they were then. There are orchards in our neighborhood that have twenty per cent disease. I think it is a treatment of the soil, especially the application of plenty of manure.

PRESIDENT JEFFREY. Address on the "California Lemon," by C. C. Teague, and discussion by R. C. Allen.

THE CALIFORNIA LEMON.

By C. C. TEAGUE, of Santa Paula.

Perhaps no horticultural business in the State has made such advances during the past few years as has the lemon business. Only a few years ago the California lemon was in bad repute in the markets of the country on account of its poor keeping quality. This was largely due to ignorance on the part of the grower and shipper as to methods of growing, handling, curing, and packing, but as greater knowledge has come, the reputation of California lemons has steadily grown, until now the established brands are sought after in the markets where they are known, at prices considerably better than the best grades of foreigns. As the supply of good California lemons has increased, the Mediterranean lemon has been forced out of the West and Middle West markets, and its market is gradually narrowing in the Eastern and Atlantic States.

The question that many growers are asking themselves is, "Is there danger of overproduction on account of the stimulus given to planting caused by the high prices of 1905, 1906, and 1907?" I think not. Why? Because the foreign lemon is the controlling factor in the lemon business. California produced about forty per cent of the lemons consumed in the United States during 1907. The balance came from Mediterranean countries. I am of the opinion that the larger the percentage of lemons produced in the United States is to the lemons consumed in the United States, the steadier will be the market and the better will be the average price. I believe that if ninety per cent of the lemons consumed in the United States came from California, instead of forty per cent or fifty per cent, that the average price to the average grower would be better. This conviction is based on the fact that Mediterranean countries always seem to have plenty of lemons to supply our markets, and New York always has had speculators ready to gamble on the chance of high prices, and always will have, so long as California can supply so little of the demand. But it seems to me obvious that if California produced nearly enough lemons to supply the market, that it would be evident to the importer and speculator that the lemons produced here would have to be sold here, and he would see that any lemons that he brought here that would cause an oversupply would mean a loss to him.

Under present conditions, all of the foreigns, representing sixty per cent of the consumption, are sold at auction at seaboard points, principally New York. This means that these auction sales absolutely regulate the price of lemons in the United States, as California lemons

can only be sold in interior markets for the New York price of foreigns, plus the freight from New York to these interior markets, and plus the premium the buyer is willing to pay for the superior quality, honest packing and grading of the California lemons, which in the latter case, I am glad to say, is often from fifty cents to one dollar a box. On the other hand, the great bulk of California lemons are sold at private sales by our different marketing agencies to legitimate dealers, and not speculators, the tendency being more and more for the shippers to build up regular trade with dealers who will look to them for a supply, and who will order the lemons shipped, instead of depending for their supply on tramp cars. This means a more even distribution and less likelihood of glutted markets, and the effect is higher prices. Do not imagine, however, that the foreigner can be displaced without a fight.

It costs money to make markets, and if we have a rapidly increasing production, we shall see some low prices during that time. This, perhaps, is well illustrated by the market conditions this winter and spring. The shipments from California, on account of the heavy crop, have been much heavier than usual, whereas the foreign shipments have been fully as heavy as usual. This means that lemons have been offered to the trade faster than they wanted them, and as the foreigner was here with his usual supply, it meant low prices; but when we shall have reached the point where we are supplying the greatest part of the markets of the country, I am confident that it will be better for the California lemon grower.

If, then, there is room for a greater lemon production, what are the requisites of success? Careful selection of location is very important. It should be as nearly frostless as possible. I believe that the sections ranging from twenty to twenty-five miles from the ocean are best adapted to lemon growing, just as the warm inland sections are best for the orange. These coast sections grow a much higher percentage of summer lemons, and the fruit is harder and firmer, although the inland section probably grows smoother fruit. The business, however, is being successfully engaged in in the inland districts.

Care should be taken in the selection of the soil. It should be loamy and well drained. Adobe soil is not suitable on account of the liability of the tree to gum disease.

A good supply of pure water, comparatively free from alkali, is necessary.

The selection of the stock for planting is important. If the soil is loamy and well drained, trees budded on sweet stock will do very well; but if it is very heavy, or the grade of the land so slight that good drainage can not be had, by all means plant sour stock, as trees budded on the latter will be much more resistant to gum disease under unfavorable conditions. The buds should come from prolific trees, producing good fruit. The Eureka and Lisbon have stood the test of time, as being the best suited to California conditions. The Eureka begins bearing earlier, produces more summer fruit, gets its fruit to size greener, and perhaps is the favorite with the average grower. The Lisbon, on the other hand, is a fine variety. It grows much larger, is hardier, more resistant to frost, the fruit smoother and produces well as it grows older.

The tendency of the lemon tree is to grow sprawly. It should be pruned so as to grow compact and full of fruit wood, and able to bear the tremendous load of fruit which it has to carry almost throughout the year.

The grove must be kept well irrigated, and in an even state of growth. This insures a smoother, better quality of fruit.

Thorough, deep cultivation is important throughout the summer months. If deep cultivation is practiced when the tree is young, there is no danger of injuring it by deep plowing or cultivating as it gets older.

Cover cropping should be practiced as the cheapest way of keeping up the humus content and good mechanical condition of the soil and of supplying nitrogen. As the tree gets older, it must also be fertilized, as it is impossible to gather from fifteen to twenty-five tons of fruit to the acre per year, and continue doing so without returning something to the soil.

Improper picking and handling fruit is perhaps responsible for more bad results than any other factor. If time and experience have proven anything in the lemon business, it is that the fruit must be carefully handled. It should be picked in as green a state as possible, and still get the size demanded by the trade. Advanced maturity—in other words, ripe lemons—means weak fruit and decay. Decay means red ink.

The grove must be kept free from insect pests, in order that it may be vigorous and thrifty. This can only be done by vigilance; thorough study of the habits of the numerous insect pests put here for the entertainment of the citrus grower, and the best methods of keeping them in subjection.

The same care must be observed in the packing or curing house in handling. Lemons should be held in the curing house at least a month before shipment, so as to eliminate by decay the weak and injured fruit. During their stay in the house, they must be properly ventilated. Excessive moisture should be eliminated, and shriveled fruit avoided. This means careful attention. If held in the house any great length of time, decays must be removed before getting too soft. Before shipment, the fruit must be carefully graded, and honestly and neatly packed.

I know of nothing that will respond to good care better than a lemon orchard. About a year and a half ago I purchased a property on which was a ten-acre lemon grove that had been very badly neglected. The grove had never been irrigated during the summer months since planting; the trees had never been pruned or fertilized; neither had anything ever been done for insect pests; neither had it ever had a good cultivation. There was a gopher under almost every tree. You can imagine the state it was in. I debated in my own mind whether or not it would not be better to grub the grove out, but decided to give it a trial, and see what good care would do for it. I immediately gave it a heavy pruning and thorough fertilization, cleaned up the insect pests and have kept it well cultivated and irrigated since. During the first year, the place netted $1,500 above all expenses of putting it in good condition. It is now full of lemons and bids fair to make a very good grove.

The trouble with some growers (of course there are none of them here) is that they are too penurious or too shortsighted to spend enough money to properly care for their groves. Perhaps you will be interested in the following expense account of my twenty-acre lemon grove, which produced 18,932 fifty-pound picking boxes during the year of 1907:

Tools and implements, 20 per cent charged off	$68 54
Frost plant labor	11 04
Harness, 20 per cent charged off	11 38
Expense, bookkeeping, telephone, office supplies, etc., including $25 per month charged to orchard for my management	662 77
Horse feed, cost of same	251 31
Cultivation	276 38
Picking lemons	2,307 66
Pruning	164 43
Irrigating	363 65
Fertilizing	545 28
Total	$4,662 44

Or $233 per acre.

I have mentioned a few of the most important things. There are others necessary to success, but if the average grower will follow the blazed trail, and give the same watchful care and attention to detail that is given by the average successful business man to his business, he will succeed.

MR. TEAGUE. Since I wrote that portion in regard to the foreign lemon, I received a couple of circular letters, which were sent out by the foreign fruit brokers in New York to the trade throughout the country, knocking California lemons. These circulars were sent to me by one of the dealers handling our lemons, but who has only been handling them a short time. I would like to read a short extract which illustrates the sort of competition we have from the foreigners, and how much better it would be if we could supply these markets ourselves and could regulate better:

It is true that California lemons are selling very low, which is due largely to the condition in which they are arriving, being so bad in a great many cases that they are not bringing freight charges. In view of the fact that California oranges are bringing so much more money than the lemons, and the market is steadily advancing on oranges, it does not seem probable that they would monopolize the time of the help on lemons, when they can obtain so much more money for the oranges. Therefore, it would seem most probable that they would divert their attention to the latter. Also bear in mind that the general condition of the majority of California lemons to be shipped, being overripe, as advised you before, one can imagine the condition that they will be arriving in a little later on with warm weather, as it is reasonable to question that they are not getting any better by remaining on the trees or in store houses in California.

That is one. Now, here is another:

The past ten days has brought out a considerable change in the lemon situation. The buyers generally seem to have little faith in the keeping qualities of the California product. In fact, the shippers themselves seem to feel the necessity of selling at any price in order to move them, and many large operators are of the opinion that when the trade are wise to the situation, that heavy purchases of imported lemons will cause an immediate and considerable advance in price.

This was sent with this note attached: "Mr. Teague—Why don't you kill him? The California stock is now killing the Dago. We bought one car of imported lemons last year, and don't expect to buy any this." (Applause.)

PRESIDENT JEFFREY. I will now have the pleasure of introduring Mr. R. C. Allen.

MR. ALLEN. Mr. Teague has covered this subject so fully that there is really hardly anything that any one else can say. I will say that last night, in speaking to Professor Powell, and asking him if he were likely to continue the same work which he has done for the orange to the lemon business, he said he thought not, that he thought it didn't need it, that it was quite evident that the chief thing needed in the lemon business is care. Doubtless that is true. But I disagree with him to this extent, that I think the same thing was realized by people in the orange business, but the work he forced on them called the people's attention to it, and they commenced to do something. I think the same thing is needed in the lemon business.

GROWING INTEREST IN LEMON CULTURE.

By R. C. ALLEN, of San Diego.

The lemon industry of California seems, with the present season, to have entered on a new phase of its career. First, we had the period, in common with most of the important fruit crops of this State, when production was small, and the only competition, that of the imported fruit, selling at very high prices. This was the time when Mr. Blanchard of Santa Paula and Mr. Johnson of Santa Barbara organized the lemon business and made good profits. After this, we had the boom of the early nineties and large plantings. When these plantings came into bearing and we had to invade the Eastern markets in order to find an outlet for the increasing product, methods which had served for the industry on a small scale had to be modified. There was much complaint at the poor keeping quality of the California lemon as compared with the Sicilian.

The general result was little profit to the grower, in many cases heavy loss, and soon there was a pretty general budding of lemon to orange trees. Though some few careful packers succeeded in building up a good name for their product, in general California lemons had a bad name. However, improved methods all along the line, in orchard handling and in the packing house, were putting the better packers and associations on to the high road to success, when some three or four years ago a severe frost in Sicily cut off imports to a low figure. Since then, and up to the present season, the general markets, both summer and winter, have been so good that there has been no chance of loss, even for the most careless and inexperienced, though the shrewd and skillful reaped the largest rewards. Obviously this was a state of affairs that could not last, but a great and permanent good was accomplished during the shortage of imports in the introduction of our California lemon into many new markets, where it has become strongly intrenched and will not easily be driven out.

Nevertheless, we have plainly reached a point where competition is again to be keen, and where there will be profit only to those who turn out a good article and build up an established reputation. Nuts, dried fruit, and, in fact, many of our products sell for what they are—on

sample—and one man's is as good as another's. Not so with the lemon. It often happens that we see a considerable difference in the price that a given market will pay for two cars of practically the same value, because one has the reputation to sustain it and the other has not. Therefore, the moral of the present situation is, unremitting effort in building up and holding such a reputation, for the man who wins it has something of which he can not be deprived so long as he does his part.

Of all the important factors that go to build up a reputation, perhaps the most important is the assurance to the trade of a uniformly good keeping quality. Mr. Powell's researches have called attention to the importance of care in the handling of oranges, and, above all, he has demonstrated that with it the fruit from districts formerly supposed to produce only weak stock can be shipped so as to stand up well. If the lack of keeping quality is a serious matter with oranges, it is far more so with lemons, and moreover greater watchfulness and system are required to insure soundness in them. Not only must the lemon stand up in transit, but the purchaser may very probably be expecting to hold his fruit for several weeks, during the process of distribution. He naturally buys those brands, even at a considerable premium, which experience has taught him are reliable, in this matter of keeping after arrival.

From another standpoint, soundness in lemons is even more important than with oranges. Practically our only competitor is Sicily. To win our markets, we must drive her out. Now Sicily's stronghold in her lemons is their excellent keeping quality. While the best brands from California equal hers in this respect, it is still doubtless true that the average of the imported fruit excels the average of our California product in standing up. The weakness of our fruit is the one criticism which we have to meet from the Eastern trade, and it is the one serious problem which must be solved if we may expect permanent success. As I said, this question of decay, important as it is, is not of such a vital matter with oranges as with lemons. Our chief competitors there are Florida, Cuba, Porto Rico, and Jamaica.

The oranges from these districts are poorer keepers than California's were, even before the reform of the last two years had cut out so much of the decay which we formerly had. The buyer of a California orange is well satisfied if it arrives sound and holds up long enough for distribution.

In so far as poor work on the part of the individual packer affects injuriously the general reputation of California lemons, it is a matter of concern to all engaged in the industry, whether as packers or growers. Such work plays directly into the hands of the importers, and we are all interested in seeing it stop.

In spite of some low prices received for our lemons this winter, the outlook is full of encouragement. We are hardly yet producing one half of the consumption of the country. Although we are not likely ever to shut out imports entirely, we ought to supply a far larger proportion of our home market than we now do. This year's crop has shown a sharp increase on any previous one, but it is not likely that this increase will be kept up, for there is no particular enlargement of acreage, and the larger crop is due to the remarkably favorable con-

ditions of the last two seasons, an abundance of moisture with no damaging frosts. Also, the good prices realized have stimulated growers to take better care of their orchards than formerly. New plantings are not large in proportion to the total acreage, and before they can come into bearing it is reasonable to expect that markets will have grown sufficiently to need all that will be produced.

The lemon business requires an expensive equipment properly to store and care for the product during periods of dull markets. Considerable loss is occasioned each season, and especially the present season, owing to the increased crop and dull markets, because of failure to supply this equipment. The large grower, who ships his own fruit, has a great advantage over the small grower. The circumstances of the case force him to realize the need for taking care of his product. In fact, unless the small growers can unite in forming associations, they can hardly expect to succeed. This, of course, has been done for years in many localities, and with excellent results, yet in other places the growers are still groping in the dark, and in such seasons as the present they become seriously discouraged. In lemons, as in all else, in union there is strength.

MR. WILLITTS. The reputation of the lemons that Mr. Allen refers to as having driven foreigners out of the market, was not built upon the fruit that was taken from the tree while it was yellow. The practice is now general among the best packers to pack this yellow fruit under entirely separate brands. Any knowledge that can be given to the growing of fruit that will mature while it is still green will do more to advance the reputation of California than anything else that can be done—even careful handling. It does not matter how carefully you handle yellow lemons, you can't make them keep very long. Mr. Rumsey said we had been neglecting oranges for lemons, but large concerns have oranges and lemons both; and in the winter, when lemons are growing fastest, we get a rain, and people can't get into the orchards to pick for a few days. Then, instead of picking the lemons that are getting yellow, they pick the oranges, and the lemons are neglected, and by and by they come in yellow and go on to the market, and those are the ones that come up against the foreign lemons, in the circular that Mr. Teague read. It is not the fault of the lemons; it is the fault of the growers. We grow lemons here that will keep as well as any lemons grown on earth. Mr. Powell has called the attention of the growers to such things, as well as careful handling, and it will probably be as well received as has been his work in the oranges.

PRESIDENT JEFFREY. Now, Prof. E. J. Wickson will talk to you upon the "University Farm School."

THE UNIVERSITY FARM SCHOOL.

By PROF. E. J. WICKSON, of Berkeley.

I can not say how much I regret that Judge Shields is not here with his address, because I was trusting to him to give the philosophy of the undertaking and to make the exhortation for its support. He has been in this undertaking from the beginning; he has been a promoter of it; he has very clear ideas of the service that it can render; and I was trusting wholly to him to present that very important phase of the matter, the discussion simply to consist of some very easily stated information, which might follow the impressive statement which I expected him to make. However, we have to take this simply with the information—the philosophy is out of it.

It is obvious to any one who attends meetings of agriculturists in California, how keen the demand among all lines of agricultural producers in California is for two things: first, research, and second, instruction. The demand for research in agricultural lines is broader and sharper than it ever was before in California, and it is producing some most gratifying results, such, for instance, as the result of the studies of Mr. Powell and his associates, which came about, as we were told this morning, on the initiative of the fruit producers of this district and the strong appeals they made to the Washington department for such studies as Mr. Powell can make.

About the same demand for research resulted in the establishment of the laboratory for plant diseases at Whittier, and the special citrus experiment station at Riverside, both of which are parts of the agricultural department of the University.

In addition to these demands for research, there are demands for instruction—the very clear demand that the Agricultural Department of the University be outfitted for more satisfactory instruction in practical agriculture. They conceded to us, largely on the basis of Professor Hilgard's excellent work for a generation, a certain standing and leadership in research, and certain discoveries in agricultural science which were of great value to the State; but they very wisely said your outfit for practical instruction in agriculture is not worth talking about, and they didn't talk about it much, except to say how bad it was, but went directly to the State, and made this first great provision for the improvement of the facilities for practical instruction in agriculture for the Agricultural College at Berkeley, by the passage of a law providing for the purchase of a University Farm, and for the equipment of that farm for demonstration purposes, and equipment also for instructional purposes. That is how it all came about, and it is only the beginning as yet.

The State appropriated something like a quarter of a million to buy a farm and to outfit it with buildings and equipment of different kinds. Then M. Theodore Kearney gave the University property valued at perhaps three quarters of a million—perhaps a million—for the same general purpose, that is, better provision for research and experiment, and, above all, a better provision for instruction in practical agriculture.

Now, I shall simply say a few things about the outfit which the State bought for us, and which is situated practically at the town

of Davisville, in Yolo County, thirteen miles from the Capitol at Sacramento. The farm is right near the railroad, and any one can get off at the depot and walk over to it. The farm comprises 780 acres, and the ground is practically flat. Sites have been chosen for the instructional buildings, the livestock pavilion, which will seat about four hundred people and admit of the showing of animals, and the creamery building. The creamery building is a regular commercial creamery, capable of handling the milk of several hundred cows. It is to be run as a commercial creamery on commercial principles, and at the same time serve for instructional purposes. It will be very complete; will be equipped for the handling of both butter and cheese in accordance with the latest approved commercial methods. Of course, we don't expect to keep on the farm enough cows to produce milk for that creamery, but will buy milk from the surrounding farmers, and will run it on a large scale as a producing creamery.

We have a water supply from a deep well, with a water tower holding a 25,000-gallon tank, about sixty feet in the air. This gives pressure in these different buildings, and also gives us an opportunity for outlook. The farm is so depressingly flat that the only place we could get any point of view was by the construction of a tower of that sort, which serves for a water tower and is necessary. There will be carpenter shops and blacksmith shops, which are for farm use and instruction also. There will be a modern dairy farm, capable of holding about one hundred animals, old and young. There are four dormitories of fifty rooms each, with a dining-room and kitchen. Ultimately, we expect to have accommodations for not less than two hundred pupils.

There are ditches to irrigate the orchard and vineyard, and also about 100 acres of alfalfa in one body and 30 acres or so in another piece. The farm is very large, and the view is imposing. The creek carries water, and a portion of it is nicely timbered with a fine growth of native trees. The country is so flat and no drainage provided naturally, that we have been obliged to put in a thoroughly modern system of drainage, consisting of proper conveyances to septic tanks and pumps from the septic tanks into the valley. This sewage is said to be perfectly harmless after going through the septic tanks, and we propose to make experiments on sewage irrigation for the purpose of testing out different kinds of eucalyptus trees and to determine how far eucalyptus growth can be used for the disposal of purified sewage in connection with a great many of the drainage problems of the valley.

There is an old vineyard, part of which we are retaining. In all probability this will ultimately be planted as a park, and some educational buildings erected there as they are needed.

We are putting up now structures that we consider to be practicable for the farm. They are the sort of thing that ought to be on every large farm. If the State requires ultimately that more pretentious educational buildings be placed there, we are saving the more prominent places for them.

We have been delayed in the opening of the structures on this farm. This has been more disappointing to us than to any one else. There were great difficulties about building. This thing came upon us right after the earthquake. One time, when bids were advertised for, there was only one bidder, so we have had some difficulty about the designing

and construction of the building. But now nearly everything that we expect to be able to build with the present appropriation is under way. We are planning for the opening of instruction in September, and expect to have things ready by that time. Instruction will begin on October 5th, with the dairy course, running from October 5th to November 25th—the dairy school and irrigation; cereals and soil, October 12th to October 31st; poultry husbandry, October 12th to October 20th; animal husbandry and veterinary practice, October 21st to November 18th; horticulture and viticulture, November 4th to November 25th. That is the course as laid down at present. The school will be open to any one who wishes to take instruction in those lines or any one of them. One can stay the whole time, or stay for a single course—any one over seventeen years of age, without examination. We intend it to be a practical course for any one who is interested in agriculture.

Of course this is only a beginning. As soon as the dormitory is completed we will have accommodations for receiving pupils as they come from the grammar schools. The idea is to take those who wish agricultural instruction at the end of the grammar school course, so that it will be a substitute for the regular high school course. Also, there will be an opportunity for those who are taking the regular course in Berkeley, the four-year course, to spend one half year, or possibly one year, on the farm, taking the practical work, after having gone through the laboratory and lecture work at Berkeley. So, you see, we plan to open this instruction to every one from the one who has finished the grammar school to the one who wants to substitute it for his high school work, and to the University regular graduate who wishes to put one quarter of his time in practical instruction, and then beyond that, we will have postgraduate study and research, and we expect to furnish ample opportunity for such things. I thank you.

(At this time an adjournment was taken until Thursday, April 30, 1908, at 9:30 o'clock A. M.)

PROCEEDINGS OF THIRD DAY.

THURSDAY, April 30, 1908, 9:30 o'clock A. M.

PRESIDENT JEFFREY. We have a little business to transact this morning. As you know, it is customary to have a committee on resolutions, and that committee will be composed of active men willing to work. Sometimes the President appoints that committee without any authority, but I would like to have your authority this morning, if you choose, to provide for the appointment of the committee on resolutions. I would like a motion to that effect.

MR. CUTTER. I move that a committee of three on resolutions be appointed by the Chair.

Motion carried.

PRESIDENT JEFFREY. I will appoint A. V. Stubenrauch, C. B. Messenger, and H. C. Rowley. Mr. Geo. H. Cutter and Mr. C. C. Chapman will advise with that committee. All resolutions will be referred to the committee, unless some member desires to bring a resolution before the house. We will now hear from Mr. R. S. Woglum on "Investigations of Hydrocyanic Acid Gas." I will say that Mr. Woglum represents the Department of Agriculture. An appropriation of $10,000 was made nearly two years ago for investigating the use of remedies for orchard pests. Mr. Woglum was selected by the department for this work. He has been at work nearly a year, and about the first of January Mr. Maskew was taken away from me by the department—a very common thing, by the way—and given work jointly with Mr. Woglum, the latter being in charge, and Mr. Maskew his local assistant. I secured the privilege from the Department of Agriculture to have these young men make some advance statements to you in regard to what they may have discovered. I take pleasure in introducing Mr. Woglum.

INVESTIGATION OF THE USE OF HYDROCYANIC ACID GAS IN FUMIGATING CITRUS TREES.

BY R. S. WOGLUM, OF THE DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

In July, 1907, the speaker was detailed by the Assistant Chief of the United States Bureau of Entomology to proceed to Southern California for the purpose of commencing a scientific investigation of the use of hydrocyanic acid gas in the destruction of injurious scale pests of the citrus. Arriving in Los Angeles during the last days of that month, consultation was held with the Hon. J. W. Jeffrey, the president of this meeting, who, it is well known, assisted materially in bringing about this investigation, and whose interest in the subject was naturally great.

In order to secure a comprehensive and at the same time thorough knowledge of the distribution of the different citrus pests in this great Southern California citrus belt, as well as to determine the extent to which fumigation is practiced, and its efficacy in different districts, the months of August, September, and October were spent in examining citrus groves from Santa Barbara to Chula Vista, including the counties of Santa Barbara, Ventura, Los Angeles, San Bernardino, Riverside, Orange, and San Diego.

Much information of value relative to our subject was secured during these travels, and the hearty coöperation advanced, as well as services rendered by the various county horticultural commissioners, county inspectors, and fruit growers with whom I came in contact, made my travels indeed a path of pleasure as well as of duty. The earnestness of these men in their duties, together with their broad knowledge of their profession, easily explains why the horticulture of Southern California has reached its present high degree of perfection.

The prevalence of noxious scale pests throughout this southern citrus belt (with few exceptions, notably that of interior San Bernardino County), and their subsequent effect on the tree and fruit, demand the attention of the fruit grower who would make his crop a most successful one. The recent researches in fruit transportation, conducted by Mr. G. H. Powell, of the United States Bureau of Plant Industry, inform us that the percentage of decay in shipment is greater in washed than unwashed fruit, all other factors being equal. To obviate the necessity of washing leads to the introduction of fruit into the packing house in a clean condition. This can be accomplished largely through the control of those scale pests which cause the dirty fruit.

There are three methods most commonly resorted to in this State for the control of the scale pests of the citrus. These are fumigation, spraying, and beneficial insects. It is unnecessary for us to mention the efficacy of each of these different practices—suffice to say, that fumigation has come to be relied upon far more generally in Southern California than any other one practice. Since its discovery in 1887, fumigation with hydrocyanic acid gas has grown so greatly in favor that to-day it is generally practiced in all the more important scale-infested districts of Southern California, as well as in other parts of the world. Hand in hand with the widespread use of this gas, an evolution of fumigation methods and equipment has taken place. The cumbersome apparatus of the earlier days has dropped into disuse, and been replaced by simplified forms.

In the first dosage system published, that of Morse, in 1887, dosage was estimated in proportion to the height of the tree, being based apparently on the contents or space represented when the tree was enclosed by a tent. For a tree 6 feet high Morse gave the equivalent of 1 ounce of cyanide; for a tree 20 feet high the equivalent of 36 ounces. His dosage throughout for trees from 6 feet in height to those 20 feet in height averaged practically ¾ of an ounce of cyanide per hundred cubic feet space enclosed.

In 1888 Coquillett gave forth his dosage system, which also applied to trees from 6 to 20 feet in height. The dosage throughout this table, as has been determined by computation, was so calculated as to produce a gas of practically the same strength for large trees as for small.

In this respect he agreed with Morse. His dosage, however, was somewhat greater than Morse's, being at the rate of practically 1 ounce of cyanide per hundred cubic feet enclosed space.

In 1891 Alexander Craw proposed a dosage system. Trees 6 feet high were given 1 ounce of cyanide, 8 feet high 2 ounces, 10 feet high 3 ounces, and so on, the largest trees mentioned, 30 feet high, receiving 14 ounces. This dosage table was probably scheduled without regard as to what the volumetric measurement of trees of the dimensions given actually was. From a computation of the volumetric values of trees from 6 to 30 feet in height, and a comparison of these volumes with the dosage scheduled, we find that for trees 6 feet high the dosage was at the rate of $1\frac{1}{2}$ ounces of cyanide per hundred cubic feet. As the trees became larger the rate decreased, until for trees 30 feet high the rate was but slightly more than $\frac{1}{4}$ of an ounce per hundred cubic feet. Hence, from this schedule, the gas would be six times as concentrated or strong for the 6-foot tree as in case of the 30-foot.

A dosage table in the "Rural Californian," which was considered so excellent as to be placed in Professor Johnson's book, "Fumigation Methods," the most extensive practical treatise on fumigation in print, was carefully examined. In this table a tree 6 feet high is given $\frac{1}{2}$ of an ounce of cyanide; one 30 feet high $8\frac{1}{2}$ ounces; with trees of intermediate size receiving a dosage between these limits. A normal shaped orange tree 6 feet high enclosed in a tent represents about 70 cubic feet; one 30 feet high represents practically 8,375 cubic feet. From this fact we see that in this particular table the tree 6 feet high would be receiving practically seven tenths of an ounce of cyanide per hundred cubic feet, whereas the tree 30 feet high would be receiving but one tenth of an ounce of cyanide per hundred cubic feet. This results that the gas for the 6-foot tree would be seven times as strong as for the 30-foot tree.

Analyses of other dosage tables, with a single exception, show a non-proportionate variation of dosage usually as great as in those already mentioned, and in some cases even greater. In brief, a comparative analysis of the dosage systems proposed by fumigation experts in the past reveals that no two are in exact accord as to what amount of cyanide should be used for a tree of given size. The range of this amount with different authorities is indeed great, some using for a certain sized tree as much as ten times the dosage that others use. And this is not all, for not only do these authorities disagree with each other, but many of them have displayed lack of uniformity in their individual tables.

Can we wonder, then, that to this chaotic condition of fumigation dosage the practical fumigator fails to resort? What satisfaction would he receive were he to turn to it for assistance? None, but rather perplexity. The problem has resolved itself into the fumigator's determining his own dosage from practical experience and results secured. If he fail to destroy the scale on a 6-foot tree in using one ounce of cyanide, he increased his dosage for the next 6-foot tree, and so on. He has also gradually learned that the dosage required to destroy some scales must be stronger than that for others.

Most fumigators have worked out their own dosage individually, and consequently the dosage used by some fumigators differs notice-

ably from that in practice with others. The estimation of dosage in use to-day is entirely guesswork. Measurements of trees are made by the eye, consequently successful results depend largely upon the uniformity of the estimator's eyesight, supported by his experience in fumigation. Under this system of guesswork, however, the results secured by some fumigators has been most excellent; by others, not as satisfactory as could be desired.

Having grasped the exact situation of the present system, it was realized that one of the very first problems before this investigation was the establishment of a basis upon which to build up a fumigation dosage with accuracy and definiteness. The only way in which to obtain this end is through the determination of the cubical contents of the space enclosed by the fumigating tent, and dosing the tree in proportion to the contents. In our work, measurements are made over the top of the tent and around the bottom. With these measurements we are able to determine immediately, and with some degree of accuracy, the cubical contents enclosed by the tent, using therefor calculation tables which we have invented.

For the generation of hydrocyanic acid gas, as used in fumigation, potassium cyanide, sulphuric acid and water are used. The hydrocyanic acid gas is derived from the action of the sulphuric acid on the cyanide of potassium. The water does not enter into the reaction, but is present merely to assist it.

A brand of cyanide manufactured by the Roessler & Haaslacher Company, which is used quite universally in Southern California, has been employed in our work. The cyanide has so far proven entirely satisfactory.

In the production of hydrocyanic acid gas we have been using the required chemicals at the rate of cyanide of potassium 1 part, sulphuric acid 1 part, water 3 parts. The water is first measured, then poured into the generator, which is placed beneath the tented tree. The acid is then introduced, followed immediately by the dry lumps of cyanide. Chemical combinations take place with definiteness; that is, when one chemical reacts on another in the production of a third substance, the proportion of these first two chemicals which enter into the reaction is always the same. Such is the result in the action of sulphuric acid on potassium cyanide. A quotation from a letter received from Mr. J. K. Haywood, of the United States Bureau of Chemistry, serves well to illustrate this point: "In the reaction of commercial sulphuric acid on potassium cyanide, for every part of potassium cyanide ¾ part of sulphuric acid is used up. According to this, ¾ part of sulphuric acid is all that is theoretically needed to convert 1 part of potassium cyanide to hydrocyanic acid. Since it is always best to have some excess of the acid to carry the reaction to completion, the ratio of 1 part of acid to 1 part of cyanide is about correct. In using 1¼ parts of acid to 1 part of cyanide there is an entire waste of ¼ part of acid. It does no good and should not be used."

As a further illustration of this point, allow me to mention the result of some tests made along this line. It was desired to determine by experiment if equal parts of acid to cyanide were sufficient to carry

the reaction to completion in the liberation of hydrocyanic acid gas. For this test two series of generators were placed in line. In one series equal parts of acid and cyanide were used; in the other series 1¼ parts of acid to one of cyanide were used. Three parts of water were used in all cases. The amounts of cyanide used ranged from 1 to 10 ounces; that is, in one generator was placed 1 ounce of cyanide, 1 ounce of sulphuric acid and 3 ounces of water; in another of the same series, 2 ounces of cyanide, 2 of acid and 6 of water, and so on in the same proportion up to 10 ounces. The second series was identical with the first, except for the use of ¼ more acid than cyanide. After generation had taken place for about an hour and a half an examination was made of the residue. In the first series, in which equal parts of acid and cyanide were used, the residue was in the form of a liquid. In the second series, in which 1¼ times as much acid as cyanide was used, the residue in several plots had collected in a mushlike mass. Puzzled at first over this phenomenon, and in order to ascertain if cyanide still remains unchanged in the residue, sulphuric acid was added, but without further evolution of gas. This at once demonstrated that all the available cyanide had been digested. Residue from some of these vessels was sent to Washington for analysis. The analysis showed that the reaction was as complete where equal parts of acid and cyanide were used as where 1¼ parts of acid to 1 of cyanide were used, and in all cases the reactions were as satisfactory as could be desired. Of all the samples of residue analyzed, in no case did the amount of cyanide lost exceed 2 per cent. In submitting the result of this analysis, Dr. Wiley, Chief of the Bureau of Chemistry wrote: "The amount of cyanide present in these samples is so small that it does not indicate to us incompleteness of reaction, but rather indicates the amount of hydrocyanic acid dissolved in the water. This view of the case is strengthened by the fact that increasing the amount of sulphuric acid in the cases above has not decreased the amount of cyanogen present in the residue. From our work, therefore, we are of the opinion that the same amount of sulphuric acid as potassium cyanide is a plenty to carry the reaction to completion." Thus, we have determined that equal parts of sulphuric acid to potassium cyanide is sufficient for a complete reaction. The adoption of three parts of water was entirely arbitrary. In all our work no injury to the tree has resulted in the use of three parts of water, therefore we see no reason for increasing the amount. Whether the amount can be decreased or not with safety we hope to determine during our future work.

But why in the experiment just mentioned did the residue of generators in which 1¼ parts of acid were used congeal, while that of those generators in which equal parts of acid and cyanide were used remain entirely in liquid form? Let me explain. When sulphuric acid acts on potassium cyanide, hydrocyanic acid, a gas, and potassium sulphate, a solid, are formed. If enough water is present, the potassium sulphate dissolves so that no residue is left. This is what happened when equal parts of acid and cyanide were used. When, however, ¼ more acid than cyanide is used there is an excess of acid. The potassium sulphate is not as soluble in water containing this excess acid as it is in water alone, hence it partly crystallizes out.

The congealing of pots is commonly spoken of by fumigators as freezing. This freezing is, I believe, usually attributed by them to be due to the presence of an insufficient amount of acid to transform all the cyanide of potassium which was placed in the generator. Such, however, is not the case.

I have just explained how excess of acid in the residue will precipitate potassium sulphate. Now, let me take up another and very important consideration, the reason for using water in the generation of hydrocyanic acid gas. I previously mentioned that water did not enter in the chemical reaction. Then, why is it used? In the first place, water is used to dissolve the potassium cyanide, as the reaction is more complete when the cyanide is in solution than when it is in the solid condition. A piece of cyanide thrown into a mixture of acid and water directly gives up some of its mass in solution. Scarcely has the cyanide passed into solution when it is transformed partly into gas. The heat liberated during this process assists in causing more to hastily pass into solution which is also immediately transformed. This continues until the reaction stops. In addition to this, water dissolves the potassium sulphate formed and so prevents it from coating the potassium cyanide. In the presence of an insufficient amount of water the potassium sulphate forms a coating around the pieces of cyanide, which retards, or even in part prevents, the reaction. In such cases this undissolved sulphate usually congeals and causes the freezing of the pots. Hence it is desirable to add water enough to dissolve the sulphate of potassium. Experiment has demonstrated to us that the chemistry of the reaction will not allow us to use less than two parts of water if we wish to avoid frozen generators within the time of exposure in common practice. The water also acts with the acid to furnish the degree of heat necessary to bring about a rapid liberation of the hydrocyanic acid gas.

During the month of November experiments were undertaken at Orange, California, to determine the dosage required for the destruction of the purple scale in all its stages, as well as to determine the effect of different lengths of exposure on results secured. In the first experiment the length of exposure was 30 minutes. In this experiment a series of tests was employed to determine the effect of different strengths of dosage. These tests were accomplished in the following manner: One series of trees were dosed at the rate of ¾ of an ounce of cyanide per hundred cubic feet of space enclosed by the tent; a second series was dosed at the rate of 1 ounce per hundred cubic feet; a third series at the rate of 1¼ ounces per hundred cubic feet, and so on, increasing the dosage of each succeeding series at the rate of ¼ of an ounce per hundred cubic feet. The highest dosage used was 2½ ounces per hundred cubic feet. A second experiment was performed which was the exact counterpart of the first in all respects, except that the time of exposure was 60 minutes instead of 30. A third experiment was performed agreeing in all respects with the first two, except in length of exposure, which was 1½ hours.

From the data secured from each of these experiments one would expect to be able to determine the killing dosage of the purple scale, provided the killing dosage ranged between the different strengths of dosage employed. To insure that the dosage sought would fall within the scope of our schedule the limits were made very broad. From the

difference in strength of killing dosage between these three experiments we would be able to determine the effect of length of exposure on the results secured.

To obviate as much as possible the factor of leakage of tents which would vary in covering trees of different sizes, trees of as uniform size as we could obtain were used. For the first two experiments the contents of the trees were of no great variation, the tree running between 11 and 14 feet in height. Our first two experiments, however, consumed most of the larger trees, so that for the third experiment we were compelled to utilize what remained. The trees of this third experiment were consequently somewhat variable in size, and noticeably smaller for the most part than those of the first two experiments. The infestation of scale was severe on many of the trees.

During the latter part of January, an examination of the results of these experiments was made. Fully two weeks were devoted to this examination during which thousands of purple scales were examined. The method was a very careful one. In all cases the scales were overturned and examined with a powerful hand lens. In those instances in which the entire contents of the scale were not at once revealed, the delicate ventral scale was ruptured, and the contents scraped out. Through this way not a single egg could escape observation. Examining the results of the experiment of 30 minutes' exposure we found live adult females on the branches, leaves, and fruit at the dosage of ¾ of an ounce per hundred cubic feet. Above that dosage all insects were killed on the leaves and the branches. On the fruit, however, some still survived at 1 ounce per hundred cubic feet, but were killed at all strengths above. The immature insects were all destroyed by the smallest dosage used. Healthy eggs were found on the leaves, and on the branches up to the rate of 1¾ ounces, but were destroyed by all heavier dosages. On the fruit, however, only the dosage rate of 2½ ounces proved a complete success. This experiment would lead to the conclusion that for normal shaped orange trees from 11 to 14 feet high and above, exposed to gasing for 30 minutes, a dosage at the rate of 2 ounces per hundred cubic feet will destroy the purple scale in all its stages on the leaves and on the branches. If the tree contain fruit infested with scale, it is necessary to increase the dosage rate to 2½ ounces to accomplish the same result.

The second experiment, which had an exposure of 60 minutes, showed that all insects on the leaves and the branches were destroyed by the dosage rate of ¾ of an ounce. No live insects were found on the fruit examined, but inasmuch as a very small amount of scaly fruit was available throughout this experiment, we are inclined to leave the effect on the fruit incomplete until further experimentation has been done. A dosage of 1½ ounces and above destroyed all eggs on the leaves and the branches. In the small amount of fruit examined, many instances of healthy eggs were found in the ¾ and 1-ounce tests. In the 1½ and 1¾-ounce tests a single case of healthy eggs was observed in each instance. In the 2-ounce test all eggs were destroyed on the fruit. This experiment would lead to the conclusion that for normal shaped orange trees, from 11 to 14 feet in height and above, exposed to gasing for one hour, a dosage at the rate of 1½ ounces per hundred

cubic feet will destroy the purple scale in all its stages on the leaves and wood. If the tree to be fumigated contain fruit infested with scale, it will be necessary to increase the dosage somewhat. The extent of this increase can not be stated with definiteness from this one experiment, due to the small amount of material available from which to secure data. This point will be determined in future investigations. From a comparison of the destroying dosage of the purple scale in all its forms on the leaves of trees exposed 30 minutes with those of trees exposed 60 minutes, we find that in using the longer length of exposure the dosage can be decreased markedly.

In the third experiment, the 90-minute exposure, a very small amount of fruit was available in the majority of the tests, so we will confine our attention entirely to the effect on the leaves and branches, which were more or less infested on every tree. At the ¾-ounce dosage rate we found a few live insects. Healthy eggs were present in all cases up to the 2-ounce dosage rate. At this and above, all eggs were destroyed. In experiment two we found that a 1½-ounce dosage rate destroyed all eggs on the leaves. How do we account for the fact that on these trees which were exposed 30 minutes longer than those of experiment two it requires ½ of an ounce more cyanide per hundred cubic feet to accomplish complete destruction of the insect in all its stages? The conditions under which the trees were fumigated were practically the same in both experiments. The chemicals used were the same. The difference was this: The trees of the 90-minute experiment were much smaller than those of the 60-minute one. There was more leakage surface of tent per cubic foot space enclosed in the smaller trees of the 90-minute tests than in the larger trees of the 60-minute tests. We know that a leakage of gas takes place through the tent. How much we do not know, and this is one of the points we hope to work out in the future. As the proportion of leakage must be greater in the small than in the large tents, necessarily the gas will become weakened sooner in the smaller tented space than in the larger. We attribute the difference of results as secured in the 60 and 90-minute experiments due to the factor leakage.

Let me give a practical demonstration and I think you will agree with me. A tree 5 feet high by 4 feet in diameter, when covered by a tent, represents, approximately, 54 cubic feet of space. The exposed surface of the tent is, approximately, 63 square feet. A tree 20 feet high by 16 feet in diameter represents practically 3,484 cubic feet. The exposed surface area of a tent covering this 20-foot tree is practically 1,005 square feet. In the 5-foot tree there are 1.16 square feet of leakage surface to each cubic foot of space enclosed. In the 20-foot tree there is but .20 of a square foot of leakage surface to each cubic foot of space enclosed. The layer of gas in contact with the tent is naturally the first to escape. Suppose that after the hydrocyanic acid gas had become uniformly distributed throughout each of the tents covering these two trees that a layer of this gas in contact with the tents an inch deep was to escape in 30 minutes. In the 5-foot tree this layer would represent 5.2 cubic feet; in the 20-foot tree 83¾ cubic feet. This 5.2 cubic feet of the smaller tree would mean that 9 per cent of the total gas within had escaped, whereas in the larger tree the 83¾ cubic feet would mean that only 2 per cent of its gas had been lost. In other words, this would signify

that the leakage per unit volume would be more than four times as great for the small tree as for the large.

Summing up these experiments against purple scale we find:

1. That the scale is as easily destroyed on the branches as on the leaves; at least where the scales are not so thickly clustered as to overlap.

2. That it is more difficult to destroy the scale on the fruit than on the leaves and branches.

3. That an exposure for 60 minutes gives decidedly better results than for 30 minutes.

4. That a dosage of 1½ ounces per hundred cubic feet at 60 minutes' exposure will destroy all purple scale life on the leaves and wood of normal shaped orange trees, from 11 to 14 feet high and upwards.

5. That the leakage of gas for small trees is greater than for large, and they consequently require a dosage somewhat greater in proportion to their contents.

Other experiments relative to this investigation have been completed. The results of these experiments, however, are so closely connected, and in part dependable on more elaborate determination, that they could not be given at present with the degree of definiteness desired; in fact, conclusions drawn from the paucity of material at hand might lead to error, therefore we will refrain.

During our future work we hope to bring to a state of perfection, not only the dosage system for the purple scale, but also for the red and black scales. This question of leakage of tents we hope to settle. The possible difference of dosage required near to and remote from the ocean will be looked into, as well as many other points too numerous to mention.

In our work, we have had at hand all the necessary apparatus. The one thing that we do ask of the fruit growers is the privilege of experimenting in their orchards. Although scale insects are broadly distributed in Southern California, it is not always an easy matter to find immediately trees in a condition best suited to our experimental desires.

PRESIDENT JEFFREY. Mr. Woglum was State Entomologist of Georgia, and Mr. Maskew has been here so long that we call him a native, and he will introduce some further facts upon fumigation.

MR. MASKEW. The programme states that I am to conduct the discussion of the paper that has just been read, and I am going to try to adhere to the text of the programme. This is an entirely new departure in conventions, originated by our honorable Chairman for the purpose of reviewing the papers that have been read, bringing out the salient points in order, making the most of them in the time allowed for them, and also answering any questions that you may see fit to bring up. Therefore I shall not attempt to discuss the question myself, but shall call upon gentlemen who are known to be experts.

One of the first points in the paper that you have just heard read is that the speaker called attention to the fact that he had been instructed to proceed from Washington to California. There must have been a very strong reason to cause the department to send this expert

to California, and I am going to ask a gentleman who was intimately associated with the reasons which brought about that cause to tell you just why it happened. Ladies and gentlemen, it is a pleasure to present to you Mr. Strong, for many years horticultural commissioner of Los Angeles County. This gentleman was the first, to my knowledge, who had sufficient moral courage to break away from the old orthodox traditions of fumigation, and it is a pleasure to me to think that I was associated with him. Incidentally, I might tell you the result of that experiment was a complete success.

MR. STRONG. About three years ago, Mr. Jeffrey and I were on the horticultural commission of Los Angeles County. We were having a good deal of trouble with fumigators and with fumigation. I had studied it, so had Mr. Jeffrey. We had got to a point where we came to the conclusion that neither one of us knew anything about it. So we knew of no better method of finding out something about hydrocyanic acid gas than to ask the Department of Agriculture to take it up and make a thorough investigation. So Mr. Jeffrey wrote to the Department of Agriculture, asking them to send men out here and take up the scientific part of the work. We could kill the scale all right, but we didn't know why we killed it. We didn't know what dosage was required; we didn't know whether we were wasting the cyanide, or what we were doing; we didn't know whether there was too much leakage in the tent, or whether there was any; we didn't know the desired time, the amount, or the length of time that a tree should be covered. So we got the Department of Agriculture to take it up. We got Senator Flint, also Congressman McLachlan, to work to that end, and they did. The result was that a year ago last winter they secured an appropriation to carry on the work, and Mr. Woglum was sent out here to take it up. I am glad that he has progressed as well as he has, but still there is plenty of room for him to go ahead. I am very much in sympathy with the work, and hope it will be successful all the way through.

MR. MASKEW. Now, we will come to the next point in the paper, and that is the question of dosage. There are fumigators who are gifted with the ability to estimate accurately the dimensions of a tree, and they have achieved almost marvelous results. But they are very few, and you will all agree with me that it is absolutely impossible for those few gentlemen to fumigate all the trees in Southern California. What is still more important, this gift is not knowledge, and they can not transmit it to others. Therefore, we set ourselves to work to give you a dosage based on scientific principles. And now I am going to ask Mr. Goodrich, the horticultural inspector of Ontario, to tell you something about the vagaries of dosage. I had the pleasure of going through the orchards in his district, and the splendid condition in which they are convinces me that he must have had quite an experience in fumigating in the past.

MR. GOODRICH. It seems strange to me that I should be called upon to speak upon dosage here, when Mr. Woglum, who has the scientific principles worked out, is unable to give you a dosage that he can guarantee will kill your scale. I have had experience in fumigating

only during the last five years. I have found with small doses I could not kill the scale, so I kept increasing the doses until we have had some degree of success. In killing red scale, we used double the amount of cyanide and acid that we do on the black scale. On a tree eleven to fourteen feet high, for the black scale dose, I should use in the neighborhood of nine ounces of cyanide, and for a red scale tree I would put on eighteen ounces of cyanide. But, of course, we don't know to an exact nicety the number of cubic feet. We never have measured our trees. We have been working under the county's supervision, and the county dosage runs from one and a half to double the amount of the ordinary dosage used by contractors, and I think that is the reason why we have gotten better results.

MR. MASKEW. Ladies and Gentlemen: There has been great difficulty in the past in accomplishing satisfactory results in Orange County. Mr. Camfield has been associated with that work, and he can bring out the difficulties they have met there.

MR. CAMFIELD. The dosage that has been applied in Orange County is as heavy as has been applied anywhere in exterminating or trying to exterminate the purple and red scale. We first tried a double dose, gave them all they would stand in one charge, and then in 30 minutes put another charge in. We found we were not getting results in that way. We found that the one heavy dosage would do the same work by leaving the tents on an hour; and I also found where the work was done under my supervision by the county tents, applying a big dosage, we were getting better results than from private fumigators. On investigating the private fumigator's work, I found that where there was more than one private fumigator in the district, they had to compete with the others, and in order to get the work, had to do it cheaper and buy less material and put less on. In some cases, the grower could buy the material, but he didn't know whether it was put on or whether it was stolen in the night. That was the trouble years ago in Orange County, I am sorry to say, where they were competing for the work so closely and keenly. They had to do it for almost nothing in order to get the work, consequently there was no good work done.

In resurrecting the fumigation question three years ago—it was all spraying up to that time—we had the worst name in the State, and it came right from Sacramento. Complaints went to Sacramento that Orange County was the hardest county in the State, the "buggiest" county. This was a hard one on us. I went immediately to work to resurrect the fumigators, but they were dead. They said they were out of business. They couldn't compete with the spray pumps. The only salvation for the commissioners then was to go around and buy up the tents, if we could, and put in good fumigators and start anew. The consequence is, that in two years' time we have got the spray pumps practically out of the way—all sold or hid in the barns, or run off and dumped into the sloughs down there. And this year there has been over 250,000 trees fumigated. We are getting clean fruit and good prices. I think that the heaviest doses we have given are the only ones

that will do for the red and purple scale. They are there all the time. All you want are conditions favorable to hatch them out. (Applause.)

MR. MASKEW. Ladies and Gentlemen: I don't quite get the point that I wished to make. Our experiments so far have led us to believe that uniformly satisfactory work will never be obtained until this method of guessing at things is supplanted by a rational one of knowing the cubic contents of the tent, and further, the system of so much cyanide must be supplanted by the system of a certain per cent of cyanide to the hundred cubic feet. We are striving along these lines all the time. Mr. Goodrich called your attention to the fact that we measured trees over and above the earth. We realized promptly to make these investigations of permanent value to the citrus growers, we must give you something practicable. A simple narration of the method employed would be of no value to you. Therefore, one of the greatest problems has been to take the methods employed by us in these experiments and reduce them to a practical basis, so practical as to make them available in commercial operations, and so simplified that they would be within the comprehension of the most illiterate of fumigators, so that they will get good results. That is, it would be futile for us to give you dosage corrected for leakage, and then have this depend entirely on guesswork.

I am afraid I am anticipating the report, but I will tell you that the United States Department of Agriculture, through the Bureau of Entomology, has originated a device that at the cost of just a few cents can be permanently applied to every fumigating tent, and will make each and every tent to which it is applied practically self-measuring the moment it is thrown over the tree. This will give you the area, and supplemented by the calculation tables invented by Professor Woglum, will, as near as we can say at the present time, make these operations easy and exact.

The next point in the paper was the question of chemicals. I think that Mr. Woglum went into that so thoroughly in the paper that a general discussion of the chemicals, in so far as we have used them up to this date, would be consuming time that might be devoted to better purpose. However, provided there are any questions that you wish to ask on the matter of chemicals, we will try to answer them.

MR. CAMFIELD. Can you give us any light on the dosage of the acid used, or the strength of the acid?

MR. MASKEW. Mr. Woglum mentioned the amount of acid to the amount of cyanide that seemed to be satisfactory. As to the difference in the acid, we have made no tests in this matter up to this time to determine if there is any difference or not. However, we have diligently pursued this subject, and we have gathered up quite a fund of information to serve as a foundation when the opportunity occurs to make these tests.

MR. N. W. BLANCHARD. What is the result when an excess of water is used?

MR. MASKEW. The result of an excess of water would be probably to lower the amount of gas available, for the simple reason that the presence of the body of water would probably take up some of the gas.

MR. BLANCHARD. Then, what is the best material for tents?

MR. MASKEW. The kind of tenting material is a question that we intend to take up as soon as the opportunity occurs in its entirety. We have many experiments going on at the present time, and we are allowing many of those to take the lead, and we expect to get benefit from them. We expect to pursue this question of tent material and the best material to overcome the leak of the gas.

MR. BLANCHARD. What is generally used?

MR. MASKEW. In our experiments we use an eight and six-ounce duck. If you went to ask a chemist if there is any difference in sulphuric acid, beyond all question he would say that sulphuric acid was sulphuric acid the world over. He would probably not call it sulphuric acid, but would call it H_2SO_4; that is, two parts of hydrogen, one part of sulphur, and four parts of oxygen. When sulphuric acid is drawn from the chamber at 52, it is H_2SO_4. When it comes from the still at 66, it is H_2SO_4. At 66 Baume, and at 84 specific gravity, 96 per cent pure, speaking of strictly commercial acid, taken at the temperature of 60, those terms are synonymous. We find on the Pacific coast that sulphuric acid is derived from two sources, one from sulphur and one from pyrites of copper and iron. In the manufacture of sulphuric acid from copper, brimstone is used. It is simply burned, and to that is added nitric acid. The nitric acid, which is an expensive item in the manufacture of sulphuric acid, is reclaimed and recovered by a a very simple mechanical process, and is available for future use at practically no cost whatever. Sulphuric acid at 66 is beyond question the best and the proper acid to be used. In the manufacture of sulphuric acid from iron and copper pyrites, these things are residue, and we have our other chemicals which pass over with the other gases, leaving the acid in the chamber of the still, and they can be refined out, and whether they are or not will always be a question on an analysis of each shipment. It is quite an expense to eliminate the zinc, the nitric acid, and probably the arsenic from sulphuric acid derived from pyrites, and it is a great saving to the manufacturer of sulphuric acid from sulphur to get back the nitric acid which can be recovered without cost. As a business proposition, I think it would appeal to you promptly that the acid furnished is the sulphuric acid derived from a sulphur basis, for the reason that these men, if they can get the nitric acid back without cost, are going to do it, and with the pyrites it is refined to get it back.

MR. CUNDIFF. Have you determined the relative length of time that it requires for the gas to escape? In seven to ten minutes it is supposed to generate or fill a tent with the gas. Have you experiments

extending along the line of finding out how rapidly, with the ordinary tents we use—usually from six to ten-ounce goods—how rapidly does it evaporate or leave the tent?

MR. MASKEW. We are not prepared at this time to answer that question. We wish to be definite and positive in these statements we make; and as to the time which must elapse for a portion or the entire amount of gas to escape from a tent of any material, we are not prepared to say at this time. Your chairman informs me that we have almost consumed our time limit. Is there any other question?

MR. S. T. MASON. How are the equivalents determined, that is, by the ordinary operator in making out his dose?

MR. MASKEW. It is one part of cyanide of potassium by weight, and one part of sulphuric acid by measure.

MR. BREMNER. I think that when chemicals are used and a chemical action occurs, there is an important point which should be explained. I would like to have some explanation as to the action of water. If they can put the water and the acid together, is there not a chemical action, and what effect does it have upon the introduction of the cyanide? What will be the effect if the water was lacking, and what would be the effect if there was no water at all, and what gas would be made, supposing water was added?

MR. MASKEW. When the acid is introduced into the water, it increases the temperature. I will say from memory, for the sake of illustration, take water at the temperature of 70, using our formula, three parts to one, and introduce this one part of acid and you will promptly raise the temperature 100 degrees, that is, to 170. This is in round numbers, because I am stating this to you from memory. We have a whole lot of data on this from which we hope to be able to derive some conclusions. The chemical action of the acid, in that case, is to raise the temperature. The temperature is raised a great deal higher—the highest temperature is brought about by the admission of equal parts of acid and water. It is a little lower with two parts of water to one, still a little lower if three to one, still lower again four to one; but it is less marked from four, five, and six than from one, two, and three. I don't care to be positive in this case. We need a great deal more data before we are sure where we are.

MR. BREMNER. Would gas be generated if we use no water whatever?

MR. MASKEW. You can take 96 per cent pure acid with a base of cyanide, and you can generate hydrocyanic gas without the presence of water at all.

MR. STRONG. Would you consider with the test that you have made, the dosage you have been using per hundred cubic feet—would you consider that practical through the fumigating season?

MR. MASKEW. Mr. Woglum made it very clear to you, and the conclusions arrived at in our experiments apply only to conditions as they occur at Orange. I will say for normal trees eleven to fourteen feet high, we are simply going to take this as a basis and duplicate it in different localities under different conditions and at different times of the year. What he set forth this morning, and he made it very clear in his paper, applies only to the conditions as we found them at Orange, and with the sized tree upon which we experimented. There are 132 different experiments performed there against the purple scale on the normal commercial trees. From them we expect to derive a base on which to conduct our future operations and eliminate a great many useless operations. We believe we have got that, and we have simply given to you the conclusions as we found them under those conditions.

MR. PEASE. I want to ask one question. Is it practicable, in a tree thirty feet high, to make the gas as dense at the bottom of the tree as it is at the top?

MR. MASKEW. We are not prepared to make that statement. We want these statements to be accurate when we make them. That will take a series of many experiments to prove. It is one of the things we hope to work out with the tenting material, with the equilibrium of the gas, the adulteration of cyanide, and a hundred other problems.

PRESIDENT JEFFREY. I will next introduce Mr. Briggs. Mr. Briggs has just returned from Washington City, where he has been making a fight for the rights of California to sulphur fruit. He is president of the San Francisco Board of Trade. I now have the pleasure of introducing Mr. Arthur R. Briggs, of San Francisco and California.

MR. BRIGGS. It is a disappointment to me that Dr. Wiley is not with us to-day. When I was first asked to prepare a paper on the sulphuring of fruit, it was with the understanding that I was to follow Dr. Wiley in a paper he would present, showing why it was not advisable to stop sulphuring fruit. I make this explanation, because it is a disappointment to you all. The question of the use of sulphur, or its nonuse, is not as interesting to the people of this part of the State as it is to those engaged in other branches of fruit growing in other parts of the State; but it is a rule which we must all recognize, that whatever affects the fruit interest in one part of the State, or one branch of that business, affects the whole. We never know where lightning is going to strike. I have reduced what I have to say to manuscript, and will therefore confine myself to it.

SULPHURED FRUIT AND ITS RELATION TO THE NATIONAL PURE FOOD LAW.

By ARTHUR R. BRIGGS, President of the California State Board of Trade.

The people of no state in the Union were more zealous advocates of a National Pure Food Law than were the people of California. Adulteration of food products in other states, suggested the need of statutory regulation in the interest of life and health and as a protection to manufacturers of pure food products. Therefore, gratification and general approval were expressed on the part of producers in this State, when Congress on June 30, 1906, passed the "National Food and Drugs Act." One of the principal features of the Act was to prevent the manufacture, or sale, of adulterated or deleterious food products, and it prescribed the method under which adulterated foods and drugs might be sold.

How comprehensively the term "deleterious foods" was to be interpreted, how a determination was to be made in respect to them, and the status of manufacturers and producers pending a determination, were matters too remote for immediate consideration and excited little interest. Later, as the law was put in operation and its scope was brought to their attention, manufacturers and distributors of food products were much exercised over the particular features of the law which affected their business.

Under the Act three cabinet officers were charged with the duty of making rules and regulations for carrying out its provisions, the specific terms being set forth as follows:

> Sec. 3. That the Secretary of the Treasury, the Secretary of Agriculture, and the Secretary of Commerce and Labor, shall make uniform rules and regulations for carrying out the provisions of this Act, including the collection and examination of specimens of foods and drugs manufactured or offered for sale in the District of Columbia, or in any Territory of the United States, or which shall be offered for sale in unbroken packages in any State other than that in which they shall have been respectively manufactured or produced, or which shall be received from any foreign country, or intended for shipment to any foreign country, or which may be submitted for examination by the chief health, food, or drug officer of any State, Territory, or the District of Columbia, or at any domestic or foreign port through which such product is offered for interstate commerce, or for export or import between the United States or any foreign port or country.
>
> Sec. 4. That the *examination* of specimens of foods and drugs shall be made in the Bureau of Chemistry of the Department of Agriculture, or under the direction and supervision of such Bureau, for the purpose of determining from such examinations whether such articles are adulterated or misbranded within the meaning of this Act.

The Bureau of Chemistry of the Department of Agriculture, by the Act, is made the agency for examination of products, and the head of that branch of the department, therefore, occupies a position of much importance. The point of safety seemed to be that it rested with the Secretary of Agriculture, jointly with the Secretary of the Treasury and the Secretary of Commerce and Labor, to promulgate rules and regulations for carrying out the provisions of the Act. It was further provided:

> Sec. 7. That for the purpose of this Act an article shall be deemed to be adulterated, * * in the case of food, if it contain any added poisonous or other added deleterious ingredient which may render such article injurious to health; *provided*, that when in the preparation of food products for shipment they are preserved by any external application applied in such manner that the preservative is necessarily removed mechanically, or by maceration in water, or otherwise, and directions for

the removal of said preservative shall be printed on the covering or the package, the provisions of this Act shall be construed as applying only when said products are ready for consumption.

No special concern on the part of those interested in fruit was felt, as to the effect of the law as expressed in the Act, and was not until the Board of Food and Drug Inspection suggested, and the Secretary of Agriculture promulgated, on July 13, 1907, "Food Inspection Decision 76." This decision was deemed drastic in its terms and made a large portion of the fruit dried in, and marketed from this State, contraband under the law. It says:

It is provided in Regulation 15 of the rules and regulations for the enforcement of the food and drugs act, that the Secretary of Agriculture shall determine by chemical or other examinations those substances which are permitted or inhibited in food products; that he shall determine from time to time the principles which shall guide the use of colors, preservatives, and other substances added to foods; and that when these findings and determinations of the Secretary of Agriculture are approved by the Secretary of the Treasury and the Secretary of Commerce and Labor, the principles so established shall become a part of the rules and regulations for the enforcement of the food and drugs act.

The law provides that no food or food product intended for interstate commerce, nor any food or food product manufactured or sold in the District of Columbia or in any Territory of the United States, or for foreign commerce, except as hereinafter provided, shall contain substances which lessen the wholesomeness, or which add any deleterious properties thereto. It has been determined that no drug, chemical, or harmful or deleterious dye or preservative may be used. Common salt, sugar, wood smoke, potable distilled liquors, vinegar and condiments may be used. Pending further investigation, the use of saltpeter is allowed.

Pending the investigation of the conditions attending processes of manufacture, and the effect upon health, of the combinations mentioned in this paragraph, the Department of Agriculture will institute no prosecution in the case of the application of fumes of burning sulphur (sulphur dioxid), as usually employed in the manufacture of those foods and food products which contain acetaldehyde, sugars, etc., with which sulphurous acid may combine, if the total amount of sulphur dioxid in the finished product does not exceed 350 milligrams per liter in wines, or 350 milligrams per kilogram in other food products, of which not over 70 milligrams is in a free state. * * The label of each package of sulphured foods, or of foods containing sodium benzoate or benzoic acid, shall bear a statement that the food is preserved with sulphur dioxid, or with sodium benzoate, or benzoic acid, as the case may be, and the label must not bear a serial number assigned to any guaranty filed with the Department of Agriculture nor any statement that the article is guaranteed to conform to the food and drugs act.

It is well known that sulphur is almost universally used in this State in drying peaches, apricots, and pears, and to quite an extent in drying plums and apples. It is admitted that the fruit when dried, in its raw state, contains a greater percentage of "sulphur dioxid," produced by the fumes of burning sulphur, than 350 milligrams per kilogram, or an equivalent of 35-1000 of one per cent. Experience has shown that the use of sulphur is a necessity, in order to produce dried fruit of the color and quality required for consumption in *any* market. It has also demonstrated that at the unit fixed by ruling 76, viz., 35-1000 of one per cent, the fruit would not keep for storage nor shipment to distant markets, nor could it be dried without serious loss from decay during the drying process. A large part of the dried fruit cured in this State did not come within the limit prescribed in Decision 76 and was therefore contraband, subject to seizure and confiscation as an unwholesome and deleterious product. The decision provided that "pending investigation of conditions attending processes of manufacture and the effects on health," * * * that the Department of Agriculture would institute no prosecutions against fruit containing sulphur dioxid when prepared in the usual manner.

This provision did not furnish sufficient assurance of safety, for

the reason that the time of immunity granted was indefinite and very uncertain.

Strong representation was made to Secretary Wilson of the Agricultural Department setting forth in forcible manner the disastrous effect Decision 76 would have from this indefinite feature as to the time on the fruit interest of the State. The Secretary visited California during the curing season of the year 1907, and afforded opportunity, both public and private, for any representations or demonstrations in respect to fruit drying in the State that were sought to be made. Under assurances given by Secretary Wilson, the business of drying, packing, and distributing fruit during 1907 went forward without much interruption.

At the beginning of the year 1908 Decision 76, by reason of limitation as to qualification for the previous year, was in force as a part of the rules and regulations for the enforcement of the "Food and Drugs Act." Uncertainty as to the future policy of the department and the apparent attitude of hostility on the part of the Bureau of Chemistry, in charge of Dr. H. W. Wiley, excited apprehension, caused a stagnation in the fruit industry in the State, particularly in dried fruits, and made further effort on behalf of growers and distributors necessary.

During the season 1907 large sums had been expended by the Bureau of Chemistry, under direction of the Agricultural Department, in obtaining samples of fruit cured by the use of sulphur, in studying the processes of manufacture, in making scientific tests and in supplying information on which the department might be able to fix a permanent safety unit of sulphur dioxid in fruit, and thus restore confidence to the fruit industry. It was presumed when the Bureau of Chemistry began its investigations in California that its findings would be made public through the department, and that producers and distributors from the knowledge thus gained, could act in the future with intelligence. It is a disappointment that no information has been given out in reference to these examinations.

Another effort was made early in the present year to obtain a modification of, or amendment to, Decision 76, in order that fruit drying, its preparation for market and its distribution might be pursued with safety on a practical basis. This renewed effort was made necessary because producers were unable to guarantee that the product cured by them would come within the limit prescribed in Decision 76, and buyers were unwilling to stand in the breach between producers and distributing merchants. The burden of responsibility rests on producers and they did not feel able to bear it. They claimed that fruit of the color and quality required for consumption could not be produced in this State which did not show, on chemical examination, if the test was made while in the raw state, an excess of sulphur dioxid over 35-1000 of one per cent. The unit fixed by Decision 76 was, in their opinion and in the opinion of distributors, prohibitive.

The Department of Agriculture appreciating the situation as it was presented to Secretary Wilson, issued a new decision on February 28th, this year, known as "Food Inspection Decision 89, as an amendment to Decision 76, the full text of which may be interesting:

> The question of the addition to food of minute quantities of benzoate of soda and of sulphur dioxid will be certified immediately by the Secretary of Agriculture to the Referee Board of consulting scientific experts.

Pending determination by the Referee Board of the wholesomeness or unwholesomeness of these substances, their use will be allowed under the following restrictions:

Benzoate of soda, in quantities not exceeding one tenth of one per cent, may be added to those foods in which generally heretofore it has been so used. The addition of benzoate of soda shall be plainly stated upon the label of each package of such food.

No objection will be made to foods which contain the ordinary quantities of sulphur dioxid, if the fact that such foods have been so prepared is plainly stated upon the label of each package.

An *abnormal* quantity of sulphur dioxid placed in food for the purpose of marketing an excessive moisture content will be regarded as fraudulent adulteration, under the Food and Drugs Act of June 30, 1906, and will be proceeded against accordingly.

Food Inspection Decision No. 76, issued July 13, 1907, is hereby amended accordingly.

The fruit industry was by this amendment still left in a position of uncertainty and in a demoralized condition. Growers held meetings, made appeals to the department through the delegation in Congress, and finally to President Roosevelt. Acting with his accustomed promptness, the President took steps to create what was denominated a "Referee Board." to which matters connected with the dried fruit industry, theretofore left with the "Bureau of Chemistry and the Agricultural Department" for determination, were to be submitted.

The Referee Board was constituted by appointment of five eminently scientific men, of extensive experience in chemistry and pathology. Its personnel is:

Dr. Ira Remsen, chairman, president Johns Hopkins University, Baltimore; Prof. Russell H. Chittenden, Yale University, New Haven; Prof. John H. Long, Northwestern University, Chicago; Prof. Alonzo E. Taylor, University of California, Berkeley; Dr. C. A. Harter, Special Inspector of Foods, New York City.

The high character and standing of this board gives confidence to those engaged in the fruit industry. It is believed the importance of the industry as it relates to the welfare of the large number of people interested in it, as well as the deleteriousness of dried fruits cured with the use of sulphur, will be carefully and broadly considered. It is felt that the conditions under which "sulphur dioxid" renders dried fruit deleterious, if it is rendered so at all by the present method of drying and handling, will likewise be considered. The hope is entertained that the findings of the Referee Board, and its determination, will furnish the Agricultural Department, independent of the Bureau of Chemistry, a basis on which to issue a new decision that will enable fruit growers and fruit dealers to pursue the occupation of drying and distributing fruit in a lawful and satisfactory way.

It is hoped also that the Referee Board, in its investigations, will come to California during the curing season. By having opportunity to observe climatic conditions, and by following the fruit from the tree to the packing house and until it is ready for distribution, the board will be better able to decide what is essential to the fruit industry in this State, than if its findings and recommendation are based on purely technical examination.

Following closely on the issuance of Decision 89, at the request of the fruit growers of the State, I went to Washington to get, if possible, a modification of that decision. The State Board of Trade had been active in efforts to protect the fruit industry of the State, and on

account of my familiarity with it and the intimate connection had with the subject at issue, I consented to undertake the task.

As a result of the mission to Washington the following official declaration was obtained:

DEPARTMENT OF AGRICULTURE, OFFICE OF THE SECRETARY.
WASHINGTON, D. C., March 11, 1908.

Hon. J. C. Needham:

In response to your personal inquiry made this date, when you called upon me in company with Messrs. Arthur R. Briggs and W. H. Brailsford, now here representing the fruit growers in the State of California, in regard to Food Inspection Decision 89, I beg to advise you that, in my opinion, it will be impossible for the Referee Board of consulting scientific experts to arrive at a determination of the question of the wholesomeness or unwholesomeness of sulphur dioxid in fruits cured by the ordinary sulphur process for a number of months, and perhaps for a longer time than that. In any event, you and the fruit growers of California may rest assured that no decision adverse to the use of sulphur will be promulgated so as to affect the curing or marketing of the 1908 crop.

The curing and marketing of the 1908 crop should be done under the terms of Food Inspection Decision 89, and if the terms of that decision are complied with, there will be no governmental interference with the curing or marketing of said crop.

Very truly yours,

(signed) JAMES WILSON, Secretary.

This was the status of the matter until April 24th, when Congressman Needham telegraphed to the State Board of Trade, as follows:

WASHINGTON, D. C., April 24, 1908.

Sulphur question will not be taken up till one year from next August. Dr. Taylor has gone to Europe and this was agreed upon before he left. Growers will have two years more before any finding is made.

Postponement of a consideration of this matter by the Referee Board, as told in Congressman Needham's telegram, affords opportunity for a campaign of education in respect to the fruit interests that may very properly be taken advantage of. Fruit drying in California is done under conditions unlike those in other states. The fruit is generally larger and juicier than that grown elsewhere. It ripens fast after coming to maturity, and must be handled quickly. The size of the fruit and its richness in juice render it necessary, when it is placed on the trays to dry, that some means of arresting oxydization be used. Sulphur, which arrests oxydization and prevents the fruit from turning dark, also assists the process of drying and has come to be looked on as beneficial as well as effective.

What is described as the sulphur process is probably known to every delegate in this convention hall, but even if this is so, it may not be out of place to say the process consists in subjecting the undried fruit, when freshly cut and placed on drying trays, to sulphur fumes formed from burning raw sulphur in a closed house or box. The house or box is filled with trays loaded with fruit. A small quantity of sulphur in an iron pan is placed on the floor and ignited, when the door is closed and the fumes from the burning sulphur pass over the fruit and leave the sulphur dioxid, which is found by chemical examination in the dried product. Sulphur is a sterilizing agent and a germicide. By its use the insect germs, if any exist, are made dormant or they are destroyed. The fruit is also rendered less attractive to insects during the process of drying than it would be if not sulphured. This is the first process in sulphuring, and if the fruit is intelligently handled only a small per cent of sulphur dioxid remains after the fruit is dried.

The dried product goes then to the packer. The fruit is purchased by

packers and dealers throughout the district in which they operate, and is put in merchantable condition by them. Taken from the growers promiscuously, the fruit is of many shades of color, kinds and qualities, and before it is ready to be marketed, requires sorting, grading, and packing. Direct from growers it is mainly unsuited for distribution in either domestic or foreign markets.

In the packing house, before it is put in boxes for distribution to the trade, the fruit is again sulphured. In being prepared for packing it is dipped quickly in hot water, which moistens the surface and softens the fruit, after which it is subjected to the sulphur process. This again prevents a change in color, and with the hot water plunge, kills any germs there may be in it. This is the process called resulphuring, and which has led to considerable criticism, chiefly from persons not familiar with the requirements of trade. While dipping and resulphuring adds somewhat to weight, it has little if any merit from the point of profit to the packer. This is taken into account in making purchases from growers, so that *they* really derive the benefit, whatever it is.

If abuses have occasionally crept in under the custom of resulphuring, this is not sufficient ground for general condemnation of the use of sulphur in curing or putting up dried fruits for market. No branch of business is entirely free from abuses, and no community is free from wrongdoers. The packing of fruit is as legitimate and well conducted as any other branch of commercial business. If excessive use of sulphur has occasionally been resorted to in the dried fruit business, it does not seem necessary to apply a remedy so drastic as to imperil the entire industry. Fruit growers and dealers generally recognize the merit of the National Pure Food Law, and are ready to uphold it. They, however, want the law wisely and justly interpreted and administered.

Abundant scientific testimony is obtainable to seemingly establish the wholesomeness of dried fruit cured in the manner usual in this State. If examination by local chemists and pathologists is insufficient, there may be added to it testimony of high authority from other states and other countries. Professor Hofman, honorary medical advisor and director of the Hygienic Institute of the University of Leipzig, Germany, in the year 1903, in an action brought in Germany to determine whether apricots said to contain a larger percentage of sulphur dioxid than was permitted in that country, testified that "neither in the literature, nor in the practice of physicians, nor in the records of the Royal Medical College, was one single case known or reported where sulphur dioxid consumed in dried fruits had caused injury to health."

Against the attitude of Dr. Wiley, of the Bureau of Chemistry, and his opinion, stand the opinions of eminent chemists both in the United States and foreign countries. If there exists a doubt in respect to the effect of sulphur dioxid in fruit dried by the use of sulphur, fruit growers should be entitled to the benefit of it, until the fact is indubitably established, particularly as the custom of drying fruit by the use of sulphur has been almost universally followed in this State for many years without any known injurious results.

But laying aside the matter of opinions and preference, the National Pure Food Law, it seems, has clearly set forth a condition under which

examinations of dried fruit should be made. The Act of June 30, 1906, in reference to food, says:

> That when in the preparation of food products for shipment they are preserved by any external application applied in such manner that the preservative is necessarily removed mechanically, or by maceration in water, or otherwise, and directions for the removal of said preservative shall be printed on the covering, or package, the provisions of this Act shall be construed as applying only when said products are ready for consumption.

It has been fully and satisfactorily demonstrated that by washing, soaking and cooking, the sulphur dioxid contained in dried fruit almost entirely disappears, at least the percentage is very greatly decreased. If ruling 76 had prescribed how tests of fruit should be made, as producers and packers claim was clearly intended, according to the language of the Act, viz., by examination of the cooked product, "when ready for consumption," no controversy would have arisen and no doubt would have been entertained of the intent of the Bureau of Chemistry or of the justice of the Act.

Another feature of Decision 76, open to fair criticism, is, that it fixed an arbitrary unit of sulphur dioxid as permissible, viz., 350 milligrams per kilogram, or 35-1000 of one per cent, prior to a determination of the unit of safety, or without attempting, so far as any public utterance of the Bureau of Chemistry is concerned, to establish such safety unit. If the unit fixed is made to apply after an examination of the cooked product, it is entirely reasonable and satisfactory. If it is applicable only to the uncooked product, it is manifestly too low. The unit of .035 of one per cent appears to reflect a theory rather than a determination on examination and inquiry based on a comprehensive view of conditions incident to actual use of the product as food.

I am satisfied that reference to the Referee Board of the issues involved in the sulphur question, and the action of that board, have the approval of Secretary Wilson, who has exhibited a disposition to protect the fruit industry of this State. Dr. Wiley maintains a defiant attitude. His endeavor seems now to be to demonstrate that sulphur is an unwholesome ingredient and should not be used, because its use produces sulphur dioxid, "an added substance which *may* render the fruit deleterious." He openly says, it is the fight of his life to maintain the position he has taken in the use of sulphur.

Aside from all scientific consideration, it may not be out of place to consider the sentimental question involved. It is no exaggeration to claim that there is in the disturbance over the use of sulphur a serious menace to the present prosperity and future development of California, which only those who know our industrial processes intimately and accurately can appreciate.

It is, therefore, important that the question now agitating fruit growers should be wisely, speedily, and permanently settled. For the crop year 1908 the matter seems to be fixed with reasonable assurance of safety on the part of all concerned, but the interpretation of the National Pure Food Law in its application to California dried fruit products is of vital and very general interest.

PRESIDENT JEFFREY. I beg to say that Mr. B. E. Hutchinson is to begin the discussion on the subject, and I take great pleasure in introducing Mr. Hutchinson of Fresno County.

MR. HUTCHINSON. I will take very little of your time. I would like to have Professor Wickson follow me. I am nothing but a practical grower, and I would like to be backed up by people who are better posted on the theories.

To say that we were surprised and alarmed when this question first came up under the Pure Food Law, and that the use of sulphur in the drying of fruit had been attacked, goes without question. We were as much alarmed as you people here were when the tariff question was up, and you wanted a tariff on oranges equal to what it was or better. We, of course, took every measure that was possible to find out what they were going to do and how we were going to get out of it, as we could not dry our fruit according to the ruling. It is an impossibility.

I shall only talk to you in a practical manner. I have been in the business twenty-three years—drying fruit—and I have tried all the different processes of drying, and I have found none that we could rely on, except the sulphuring of fruit as we do it now. That there are some who abuse it we are willing to admit, as well as you are willing to admit that some of your oranges are not picked and brought into the packing house as they ought to be. We have some careless men who make a great deal of trouble, but if the fruit is sulphured as it should be and proper care taken, with the owner in charge and doing it himself, without leaving it to some Chinaman or irresponsible person, we can show you fruit that is acceptable and will be eaten by anybody without any danger of being injured by it. Of course there are some people who sulphur their fruit too much—some that put it in carelessly and leave it all night, which is very wrong. We don't eat dried fruit raw; we don't take it as it comes from the producer and eat it that way. It is cooked, and after it is cooked there is no sulphur to amount to anything left. This we have demonstrated, having those who were strongly opposed to us get the analysis of it after it was cooked, and we never had any trouble after that.

You have many ways here to get rid of your scale and of your insects of all kinds—more trouble than we have in our part of the State, but we have our troubles, too. Correct sulphuring of fruit, as I have demonstrated, is not to leave it in the sulphur house more than two or three hours. Some men buy the cheapest of sulphur, and it will go out and won't burn. You can't expect to get an even grade with that, and you don't get it. But where they will use as near the right amount of sulphur as is possible, it is all right. Some days it takes more sulphur than it does other days, and you have got to be there all the time to look after it carefully. Never leave it in the sulphur house as long as three or four hours. It is not necessary. The sulphur will take in a few hours well, if it is good sulphur, then take the fruit out and spread it.

Our peaches we are obliged to put out into the sun. We do that. The sun does all the work. It is not necessary to build these expensive buildings to dry by artificial heat. We have been asking all the time for some other way to dry our fruit that would be within the law as they have it. We don't want to break the law. We don't want to be complainers. We have asked it, but we have never got an answer. We have been told by Dr. Wiley the way of doing it with salt instead

of sulphur—sprinkle it with salt water, etc. Why, that was tried with us twenty-two years ago and abandoned. You can't do it. Then they say do it with driers—get steam driers and dry that way. Why, with the amount of peaches that we have in our county, the idea of building a drier big enough for any one that has a large orchard to dry his fruit is simply ridiculous; you can't do it; and you can't dry without sulphur. If you sulphur it, it will dry; it will dry very much faster after sulphur. That would leave the poor man with ten or twenty acres at the mercy of the larger ones, the same as we are at the mercy of the packers now. We can't dry fast enough so that we can dry all of the fruit there unless every one dries his own, and they must make preparation to dry their own instead of getting it dried by others. The idea of drying in that way is simply ridiculous.

In my boyhood days they dried principally apples. They put them on strings and hung them in the house. We had fireplaces then. Of course the flies and insects got at the drying fruit, and I don't think it made it very much better to use than our sulphur. Still, they want to force us to that.

In the case of Dr. Wiley's idea of drying in dry houses by steam, he tried it with apples. Apples are cut in thin strips and dry very easily and quickly. You can dry apples without sulphur, and they will look fairly well, and people buy them; but when it comes to peaches, they can not be dried without sulphur. I have a sample that was given me by a gentleman who made an affidavit that it took four weeks to dry it. It was given me to take to Washington. It was the culls that they would not take at the cannery all summer, and he dried them without sulphur, and it took him four weeks. I have his affidavit to that effect, and he said, "Take it there, and have it cooked by the side of some of your own and pass it over to these scientific men, and I will guarantee we will have no trouble, because you can't dry this fruit without sulphur and have it all perfect. A great deal of it will be in such shape that we don't want to use it."

Now, as Professor Wickson is here, I would like to hear from him. Our time is short, and I don't want to take up the time of any other speaker. It is very interesting to us to hear the papers, and I will call on Professor Wickson to close this discussion.

PROFESSOR WICKSON. Mr. Hutchinson did not tell me that I was to be called, and he has not told me yet what I am to speak about. He did make the general statement that I was to back him up, and I will do that all right. But he doesn't need that any more than Mr. Briggs needs it, so my speech will be exceedingly short.

The statement which Mr. Briggs has made covering his wide study and energetic action in behalf of the dried fruit interests of California, needs no backing up. It speaks for itself. Mr. Hutchinson is a man who speaks from a quarter of a century of actual experience in the handling of dried fruits by the sulphur process. Their deeds and their works need no support whatever from me. I will only say that it is very difficult to exaggerate the importance of the use of sulphur in California. This practice is a survival, as Mr. Hutchinson intimated, of a third of a century of actual and earnest endeavor to find something else. Fruit growers don't want to sulphur their fruit. It is a lot of

bother, and if the fruit would sell without sulphuring, it would be an advantage. The impression seems to have gone out somehow or other that fruit growers rather enjoy sulphuring and dislike to give it up. That is altogether a false impression. If the fruit would sell and go on to the world's markets as it is doing at the present time, and it could be done without sulphuring, I guess the fruit growers would enjoy it more than anything else.

So to close with a word, the endeavor which Mr. Briggs made near the close of his paper, that this matter be kept alive and constantly studied into from the point of view of commerce of our fruits, is eminently proper. Every one interested in the advancement of the fruit interests of California should make it his particular business to understand this question, of what importance it is economically, how interesting it is from the point of health, and to appoint himself a committee of one to get wise on this question of sulphuring, so we will have something then that will be a fund of information to draw upon as the matter may come up subsequently. For the next two years I think it will be all right, but it needs a campaign of education, and a popularization so that the importance of the matter to California may be enforced upon the attention of the whole people. (Applause.)

PRESIDENT JEFFREY. I am glad to introduce Professor Mackie, of the Soil Survey, acting for the Department of Agriculture, and he will present to you a paper as indicated by the programme to-day, to be followed by Mr. Mills in a discussion of a few minutes.

SOME RELATIONS BETWEEN SOILS AND FRUITS.

By PROF. W. W. MACKIE, of the U. S. Bureau of Soils, Washington, D. C.

Although the relations between soils and fruit crops are extremely important, these relations have been generally overlooked on account of the very apparent influence of climate. Thus, without any direct reference to soil conditions, we have divided our State into climatic fruit belts. We have citrus belts, prune belts, raisin belts, etc., each with its own peculiar climatic feature, and have assumed that these areas were eminently fitted for these especial crops. This is true, in a measure, but within each of these fruit belts exist many kinds of soils, some of which are unfit for the fruit crop to which the region is mainly devoted.

Many failures could have been avoided by proper attention to this feature of soil selection alone. In our citrus belts may occur soils too sandy or too gravelly for proper growth of trees. Again, the subsoils may contain hardpan, which would seriously interfere with the percolation of water or penetration of roots. The water table may be too close and drainage poor. Prune districts may contain soils with gravelly subsoils, which allow the moisture necessary for maturing the crop to escape during the growing season, thus reducing the size of the fruit and crop. The peach orchard may be planted in heavy or hardpan soil, where cold spring rains sour and destroy their roots, finally ruining the orchard. Many such effects of soil variation within a well recognized fruit belt could be given.

SOIL SELECTION.

On the other hand, certain success may be secured by selecting soils which especially favor the crop to be grown. Prunes produce heavier crops and larger fruit when grown on deep alluvial soils ranging from deep sandy loams to silt or clay loams. Such soils more readily carry moisture through the dry summer while the crop is growing. These soils likewise hold irrigation water better, and are usually richer than more porous or gravelly soils. Peaches prefer sandy soils of a light color, possessed of good drainage and free from close hardpan. The Muscat, or raisin grape, which has proven so successful in the San Joaquin Valley, does best on a light brown or gray sandy loam. When the soil changes into a light loose sand, adobe or red soil, this grape fails to do its best. The Tokay grape, which depends almost entirely upon its rich flame color for its success, shows great variation within the belt known as the Tokay belt. These variations can be traced, as a rule, to the changes in the soil. The best colored Tokay grapes usually grow on a red or light red sandy loam or loam soils, most of which are underlain by hardpan or heavy clay. When grown on light gray sandy soils, or rich dark alluvial loams or silt loams, a large grape is produced, but its color is very inferior, being either too light or too dark and unevenly colored. So well recognized are these soil effects, that some types of soils are known as Tokay soils.

It is the work of the Bureau of Soils to definitely identify these soils in many areas in California, completely outlining them upon maps, which show the exact location of the various soil types encountered. The characteristics of these soils, such as origin, topography, color, texture, depth, fertility, etc., are then described, together with their special crop adaptation and special methods of culture best adapted to them.

With this aid it becomes possible for those desiring to enter into the field of fruit growing to select the soils and localities best suited to the fruit they desire to grow, whether it be Tokay or Muscat grapes, shipping or canning peaches, prunes or oranges.

THE IDEAL SOIL.

The ideal soil may be described as one which readily permits the percolation of rain or irrigation water and, at the same time, has capillary power to draw the moisture from its depths to the surface for the sustenance of crops. Such a soil is deep, very uniform in texture, with almost imperceptible demarkation between soil and subsoil. A fine sandy loam may be termed an ideal soil.

While the soil just described may be best for general crop production, variations from it often meet the conditions required by special fruit crops. It happens in this manner that certain soils, not generally ranked very high for general cropping, become very productive under the culture of special fruit crops, such as the orange, grape, and olive.

Deciduous orchard fruits are perhaps the most exacting in their demands for ideal soil conditions. While many of them show considerable range in soil adaptation, as a rule they are limited to the better types of soils. Impervious subsoil and hardpan usually show their injurious effects by the presence of die-back or rosettes at the end of

twigs, and early or unusual dropping of the leaves and fruit. Poor drainage and the presence of alkali also injure those orchards. The effect of changes in soil types upon the various deciduous orchard trees is often plainly marked. It has been observed in the case of apple orchards grown in the same valley, with similar climatic and topographic features, that a change in soil texture produced a striking change in quantity and quality of the crop. A variety grown on sandy loam soil produced a large crop of bright, highly colored fruit, while the same variety in the same orchard but on clay loam soil produced almost no crop at all, and this of an inferior color.

The peach shows similar variations due to change in the soil. A superior shipping peach is produced on the coarse granite sandy loam in certain districts in the Sierra foothills, while the better grades of canning peaches are grown on alluvial river and valley soils. The light sandy plains soils produce a better drying peach. The cherry, aside from its climatic preferences, demands a deep loose soil, free from heavy subsoil, hardpan, or close ground water.

The prune thrives best in a mellow soil of medium to heavy texture, varying from sandy loam to clay loam. A uniform silt loam which holds moisture easily is its ideal. Other deciduous fruits show like preferences.

Citrus fruits show similar preference in soil types. They prefer soils with good surface and subsoil drainage with favorable exposures. Rich soils when low and too moist produce fruit low in acid and sugar, practically eliminating them from the citrus class. The citrus fruit does not show the same degree of aversion to shallow soils as do some of the deciduous fruits, like the cherry, peach, and apricot. When drainage is good, oranges and lemons often do well in four feet of soil over very impervious hardpan. Where blasting is practiced, even less depth has grown good orchards. Such land should be planted, however, only when all other suitable soil has been occupied.

The olive which is now attracting so much attention in portions of California grows on a wide range of soils, growing in either sandy or heavy soils, shallow or deep ones, and will tolerate a considerable amount of alkali and drought. The ripening of this fruit, however, varies greatly with the change in soil. The red sandy loam and light loams ripen the fruit sometimes many weeks ahead of the heavy dark colored soils which are often so cold that the fruit never fully colors. This makes it imperative to select early ripening varieties for the heavy soils, while late ripening sorts, like the Mission, can be planted on the early maturing soils.

It can be said of most orchard fruits that the soils suitable for successful growing are somewhat restricted. These soils are usually of the highest class, clearly placing the orchard districts in the first rank of soils.

GRAPE SOILS.

The grape shows a much wider range of soils than orchard trees. Vineyards have followed the clearing of brush upon the hillsides, have again covered the abandoned grainfields with profitable crops, and have even covered wind blown sands and desert areas. As California has almost a natural monopoly of the vinifera or European grape, the

soils suitable to its culture become of prime importance. In bringing the abandoned grainfields back to a state of high cultivation and profit, the grape has done more, perhaps, than any other crop now grown in the State. In this work it is scarcely well started. In the San Joaquin and Sacramento valleys are many such abandoned grainfields. On many of them, especially on the red sandy loam or hardpan land, wine and table grapes have converted those fields into the most prosperous of farms. The Tokay grape has been found to produce best on just such soils. Wine grapes show fine returns, and produce a grape excellent in quality and color on these abandoned fields. Many areas of loose or wind blown sand, which were either wholly unfit for cropping or had been abandoned for grain farming, have been found to be suitable to grape culture. In some of these areas irrigation with pumps is possible for grapes, because a small amount of water in furrows will go a long ways. When water from ditches is scarce, the planting of vineyards is welcomed in such sandy soils in irrigated districts, on account of the conservation of the water for such crops as alfalfa, which requires flooding. Other important soils reclaimed by the grape are those found in unirrigated districts which can not be irrigated. Many such soils, when planted to grapes and cultivated at such time that moisture from the sky above or subsoil below is carefully retained, give good returns. Such culture in areas of deficient rainfall may be called dry farming or the "Campbell" system applied to perennial crops. These crops are much more certain than grain crops, and are well adapted to this culture. Soils thus treated range from wind blown sands to adobe or clay soils. The sands of the San Bernardino Valley, now being extensively planted to grapes, represent such soil and culture. Many heavy soils in the interior valley produce good vineyards by proper cultivation when no irrigation is possible or profitable.

HARDPAN.

In the utilization of hardpan soils fruits, and most especially grapes, have played a most important part. In the San Joaquin and Sacramento valleys there exist two great classes of soils containing hardpan at depths sometimes too close to the surface for orchards or alfalfa. These classes consist of the red soils lying near the foothills and underlain by red, or iron hardpan, and the gray or brown plains soils underlain by white hardpan. On the red hardpan soils vineyards have been planted until it is now surely demonstrated that four feet of good soil is sufficient for a good vineyard. In fact, this is considered more than is absolutely necessary for good grape production when the top soil, to about a foot in depth, consists of a mellow loam or sandy loam and the immediate subsoil a tenacious red clay loam, making a total depth of only two feet. Excellent vineyards have been grown on such combination of soil, this entirely without irrigation. While this condition of soil and subsoil is the extreme, it shows that shallow hardpan soils with proper care and cultivation can be made to produce profitable vineyards. It is even true, in some localities, that such grapes as the Tokay and Emperor show better results under just such conditions.

In a number of instances the appearance of ground water within a few feet of the surface has been taken advantage of by vineyardists to

make profit out of this otherwise detrimental state in the soil. This is only possible, however, in soils free from injurious amounts of alkali which would otherwise rise to the surface.

In some instances hardpan soils have been blasted to grow orchards. Such blasting must, for best success, be done in hardpan which is not too thick and is underlain by a sandy soil directly underneath. Where such conditions occur, citrus fruits have thrived, and even such trees as the peach have done remarkably well. Warning must be given concerning the character of hardpan encountered, for in all cases it is necessary to break through into sandier soil below. Where holes are blown into hardpan without breaking through it, such holes are the receptacles for excess water, both in summer and winter, often causing the souring of roots and damage to orchards.

ALKALI AND FRUITS.

The relation between fruits and alkali in soils is often very marked, depending greatly on the character of the alkali. It has been observed in vineyards that the variety of grape has little to do with the resistance to alkali, but the texture of the soil exerts considerable influence. Sandy soils containing alkali exert a much more injurious effect than do heavy or clayey ones. Quantities of alkali have been found in good vineyards on heavy soils which would entirely destroy the same vines in light sandy soil. The color of grapes is often considerably reduced by the presence of alkali. This necessitates changing of varieties on certain soils thus affected, forcing the vineyardist to plant the colorless or white sorts.

Among the orchard fruits less affected by the presence of alkali than others may be mentioned the fig, olive, pear, and pomegranate. These have all shown a tolerance of alkali considerably in excess of other orchard fruits. The citrus is particularly affected by alkali, especially the chlorides or common salt. The presence of excessive quantities of lime or marl in citrus groves often causes yellowing of the leaves, but as this condition is encountered only in one or two particular soil types, careful selection of soil will avoid this evil.

SOIL FERTILITY.

Perhaps the most important, most baffling, and least understood relation between fruits and soils is that of fertility. The almost endless variety of fruits grown in California, the various qualities desired in them, and the great variation in soils render this subject of fertilization very complex. A fertilizer which will do well on one type of soil will not give the same results on a different one. Different crops show corresponding differences in the effect of fertilizers. Out of these conflicting statements some generalizations may be drawn. It may be generally stated that the soil which is most ideally perfect in physical texture and depth is usually the most fertile, containing plant food in the best condition for plants. This may be explained partly by the fact that the ideal soil permits of slow but perfect percolation of water downward and similar rise of soil water upward under the influence of capillary power and heat. Such a passage of water not only distributes the soluble plant foods evenly throughout the upper layers of soil,

but it brings in contact with the tied up or unavailable plant food the soil solvents like carbonic acid, water soluble inorganic acids, and organic acids exuded from roots of plants or generated by plant decay, making these plant foods immediately available in small but constant quantities. So great is the body of soil thus affected by this process in the perfect soil that little exhaustion is felt in any particular portion or within an appreciable length of time.

Departures from this ideal condition require a careful study of fertilizers, depending upon such factors as the restriction of water passage by the heavy texture of the soil or the rapid leaching of soils from too porous a texture. In both these extremes, the capillary power in soils is greatly decreased or restricted, permitting the exhaustion without replacing the available plant foods in the soil thus cropped. Such soils often need fertilizing, but the question is, What kind of fertilizers shall be applied; how can the greatest benefit be derived from their use? The quantity of plant foods available in soils is extremely difficult to determine, and soil chemists are not at all agreed on the proper chemical methods to determine this. It is very likely that no chemical method will ever be devised to accurately determine the plant foods in soil available for crops. Each plant seems to possess a different power of extracting these plant foods from soils, and I am inclined to agree with Professor Wickson, who once said that the best analyst of the available plant food in soils was the plant itself. Such a view renders uncertain the determination of exact application of fertilizers to soils, except as tested by the actual application to crops grown upon each soil. This is likely to be a slow and uncertain process, but is in accordance with the most successful fruit growing. Fertilizers should not be applied at all until every other practical available method of maintaining or increasing the soil fertility has been thoroughly tried. Such methods include better and deeper cultivation, application, and conservation of moisture in the soil and attention to such features as drainage, aëration of soil and subsoil, and the determination of deleterious substances like alkali, etc.

But more important than all these is the preservation and incorporation of humus, or decayed organic matter, in the soil. California soils appear to depend for their fertility upon this perhaps more than any other single factor. In this humus is held the major part of the available plant foods. As humus is found in the upper part of the soil column, and to a much lesser extent in the lower depths, or subsoil, it will be seen that the presence of humus is most important in the growing of crops. Nitrogen, which is more rapidly exhausted than any single plant food, is held almost exclusively in that part of the soil containing the humus. As this humus is found mainly in the upper part of the soil column, the nitrogen is therefore exposed to greater exhaustion, not only by the growth of crops themselves, but by the action of the elements and the burning out by the summer sun. This burning out of humus and consequent reduction of nitrogen has been one of the prime factors in the exhaustion of grain soils, especially those systematically summer-fallowed and left exposed during the whole of the long summer season. The clean culture in orchards and vineyards closely resembles this summer-fallowing of grain lands, and permits of the same evils. To such cleanly tilled soils commercial

fertilizers can not have their full effect, and may even cause some injury in puddling or causing the soil to run together, as well as burning it out, often leaving it worse off than before. To offset this effect of commercial fertilizers, or to retain the fertility of the orchard or vineyard without them, the incorporation of organic matter, or humus, in the soil becomes a necessity. To do this, and at the same time increase the nitrogen content, the growing and plowing under of green manure, or leguminous crops, has proved by far the most efficient means. However, the application of barnyard manure has been highly satisfactory for the purpose of increasing the humus in soils, as well as improving its general tilth. The action of this increase in humus in the soils, by either plowing under green manure crops or the application of barnyard manure, is seen in the improved tilth of the soil, and most especially in the increased capacity of the soil to imbibe and retain the optimum water content, the quantity of water necessary for best crop production. This improvement in the water carrying capacity of the soil in turn tends to render more soluble, or available, the plant food already there, and to replace from below the quantities removed from the top soil by the plant.

In the work of growing green manure crops in orchards, the citrus growers of Southern California have made astonishing and most gratifying progress. I believe I am correct in stating that they have found that the most satisfactory and conclusive benefits in orchard fertilization have been obtained from the growing of green manure, or legume crops, and the application of barnyard manure. The benefits, however, are out of all proportion to the actual quantity of plant foods added to the soil by either. This may be explained by the fact that the increase of humus increases the availability of the plant foods already in the soil, and at the same time retains them near the surface, where the feeding roots of trees secure their supply of plant food.

It is apparently true that few soils are actually so rich that the application of a complete fertilizer to the citrus orchard is not either beneficial or necessary. In conjunction with this practice it will always be found that the increase of humus by the growing of green manure crops, and the application of barnyard manure, will render such commercial fertilizers much more effective, and at the same time remove any evil effects they may have upon the soil.

MR. JAMES MILLS. I will ask Mr. Koethen to say a few words on this subject.

MR. KOETHEN. Professor Mackie has given us a very good résumé of the subject. There are some things that have been said in which I, for one, do not agree with him. I do not believe that the heavy soils are not well adapted to the growing of citrus fruits. I believe I will be borne out by the testimony of some who are here. We all know that the early premiums that were taken for citrus fruits were taken by trees grown on heavy soils. What we call the red adobe soil, such as you find in Redlands, is recognized by most citrus growers as the best for a citrus orchard. I believe that is uncontroverted, and that is probably one of the stiffest soils we have—stiff red clay.

I have in mind one particular orchard, of which a portion is sandy soil. There was something wrong. I was asked the question as to what the cause was. I returned with the question as to what was the matter with the subsoil. I asked if they had examined the subsoil. You will usually find that there is something wrong with the subsoil. There is either hardpan or gravel underneath. I know now of a five-acre orchard where, right through the center, there are about three rows of trees which are motley. They have never made sufficient growth, and show all the indications of ill nurture. I had the man examine the subsoil, and he found gravel within three feet of the surface. The rest of the orchard was not in that condition, and by the application of heavy quantities of humus-making material he has practically overcome that, and those trees are now in a healthy, vigorous condition, showing that while the gravelly subsoil may be a detriment to an orchard, it can be overcome by the addition of large quantities of humus. Heavy soil is evidence of fertility. Hence, a citrus orchard that is planted without the addition of fertilizers will soon lose its value. It costs more, in other words, to keep up the fertility in a light sandy soil for citrus fruits than it does for heavier soils.

Now, just one more word and I will close. Professor Mackie is right, that citrus growth is particularly adverse to salt in the soil, and I think that we must be very, very careful in the selection of commercial fertilizers that they do not contain salt. That may occur in some of the animal matter from the products of the packing house, where they have been careless in allowing salt from the washing or the leaching from the vats to get into the tankage. I don't know of any particular case where that has occurred, but it might happen. I do know this: I know that the chief ingredient, or rather the chief defect, in nitrate of soda is common salt. Now, that does occur in the natural beds, but where that does occur in nitrate of soda it will almost invariably bring bad results, because our soils are naturally pretty rich in salt already, and just a little may tip over the balance and cause trouble.

PRESIDENT JEFFREY. Professor Mackie would like to make just one statement.

PROFESSOR MACKIE. I would like to state in regard to what has been said about heavy soils, that I was not aware that I said heavy soils would not grow good citrus fruits. In many types of soil we agree that the citrus fruit grows well, but that the ideal soil is not of that sort, taking everything into consideration. I know the clay soil at Porterville, and the red adobe of the foothills, and even the red soil of this county, produce an excellent quality of orange; but there are some defects in those qualities of soil and subsoil which I recognize in my paper.

MR. C. C. CHAPMAN. We have remarkable soil in California. There is not one of us but boasts of his soil. A man in Orange County was showing an Easterner around, portraying the grandeur of the country and the excellent soil, and he said, "I will just give you a little demonstration of the quality of our soil. I have some cucumber seed I will plant, but get ready to get out of the way as soon as possible."

They threw the seed down and started to run, but had not gone far before they were overtaken by the vine and had to call for help to extricate themselves. That is our California soil.

I think that while the soils may have something to do with the character of our fruit, I am quite sure that we can grow fruit of equal character on any soil—it don't make any difference. Here is where intelligent farming comes in. I have from a very light sandy loamy soil to a very heavy soil, almost to adobe, and I grow fruit of equal keeping qualities on one the same as the other. So that I think if all of our farmers would come to these institutes and these conventions and hear these papers, and go home and put into practice the knowledge they have gained, they will find they have overcome almost any deficiency of soil or any obstinacy of heavy soil or deficiency of light soil, and grow an equal quality of fruit. We do it down in Orange County.

MR. MILLS. Allow me to say with Mr. Chapman that if our horticulturists would come to these meetings they would carry away a very great deal that they need. Those of us who come to them go away from them with something always, and sometimes with more than at other times. I wish to apologize to you, who have come from long distances, for the mere baker's dozen of Riverside horticulturists who have been among you. They need the information, and they need it mightily.

MR. CHAPMAN. Maybe they think they know how to grow citrus fruits.

MR. MILLS. That is the trouble. The subject is the "Relation of the Soil to the Fruit." The fruit we grow, the vegetables we grow, the crops we grow of different kinds, must have something to grow upon. The soil is but the stomach which supports the tree and grows the fruit. Man is but a walking tree. He has not got his feet stuck down in the soil like the tree and made stationary, but nevertheless he grows, and he does his work much like a tree. He has got to feed, and the food has to be digested and made into forms that will force the vital fluids through the body and build up the structure with which his mind will work, and he will do the work that God has given him to do. If man carelessly watches his physical conditions, if man foolishly eats that which is not good for him, he becomes unhealthy—otherwise, physically unfit to do the work given him to do, and you see him walking up and down through the earth, a wreck of a man, unfit for the work he has to do.

And so we see in our orchards, conditions that lead us to believe that the relation of the soil to the fruit is not just right—the relation of the stomach to the man, or the stomach to the tree, is not just right. We have got to have conditions right if we are going to grow the fruit that we want, and grow the quantity we want to grow and the quality we want to grow. Fruits need water, they need nitrogen, phosphoric acid, potash, sulphide of iron, chlorine, and other things; but the things we have to deal with, which the tree needs for the growth of itself and the production of its fruits for the children of men, are three things, next to moisture—nitrogen, phosphoric acid, and potash.

The soil first is for the rooting of the tree that it may stand upright, that it may get the food and the water that it needs from the soil—largely from the soil. We must get a deep rooting system if we are going to get a uniform condition. We speak of men and women as superficial; they are not deep-rooted down in the faith of things that they may live a uniform, consistent life persistently. It is the same thing with the tree life. The root must be deep down in the soil that it may not be affected by the things that affect tree life. The sun in the heavens in California in July and August is so hot that the tree that has a shallow rooting system is undone; it can't make a uniform growth. You pour the water over the soil, and, as Mr. Smith said yesterday, it drinks it up like the famished man on the desert until it poured out over the stump that he was experimenting with. So we must be deeply rooted. Our trees must be deeply rooted, that they may have their roots away down yonder beyond the effect of the hot sun of summer and of the cold nights of winter—they come both hot and cold. The tree which has been coaxed out in its youth to live a superficial life, and its root system runs out all over the surface, will continue to live that way for a long time, unless you deal radically with it. It looks for its drink constantly before others are looking for it. Two weeks, three weeks, and the leaves are wilted and die, because the roots are on the surface, and the moisture that is near to the root system is soon exhausted, and the tree is calling for water again. But just yonder over the line, another orchard differently treated, with its roots down deep under the earth, will go along five, six, seven, eight weeks, gloriously living its life. Not a leaf is affected by the hot sun. It is living a uniform and consistent life. You have helped it to live that life, as you have tried yourself, possibly, to live that consistent life. Therefore, I say first, that you must enable the tree to be deeply rooted, that its relations with the soil, the fruit, and the soil relations may be right.

The tree needs food. There is in the soil more or less food, and while the chemists say, and say truly, that it is impossible to tell how much that orchard may need when you have analyzed it, yet I believe that in the long run the man who knows his orchard, knows what is in it down as far as the roots—having experimented with his shovel in a dozen places on his orchard to know what he has got to deal with in the subsoil as well as on the surface; and I am sorry not one per cent of you know it, because you have not taken your shovel and gone down and down to find just what the conditions are physically in your orchard. I say that he who analyzes its soil and puts it on paper, and continues to do it, will have some knowledge that is of some use to him.

Let me tell you, in passing,— and I would not speak of myself, but it may be of assistance to you,—that the laboratory on our groves is teaching us something and teaching us great things. The laboratory on Arlington Heights, I assure you, will enable us this year, because of the information gained, to keep in our pockets $50,000 that we would otherwise spend if we were in the dark. But we have found light through our laboratory, and we will save this year $50,000 because we have spent two or three thousand. It is worth your while.

But there are thousands who forget the relation of the tree and the soil to the fruit, and they say, "Oh, there is enough there; I am not

going to do it." Look you, this morning's paper! The trains are not able to bear the immigration from our shores across the 49th parallel to the rich lands of the Canadian Northwest. Why? I will answer it, and remember the answer, because you need it in California. Because they selfishly exhaust the humus, the life, from the soils of the glorious West of America, and have left it for their descendants and future generations to rebuild it. It ought to be a crime, and the law ought to say so (applause), that men who are given for a time—a short time this life is—the right to cultivate the soil, shall exhaust its wealth to put it in their pocket and to jingle it until the clods of the valley cover their carcasses. No man has any right to take that wealth upon which we live, and upon which three hundred million, I believe, will live here in the year 2000—but how will they live? Look you, how the forests are depleted—the relation of the soil to the fruit. Look you, how when the forest is gone the moisture is gone—the relation of the soil to the fruit. Look you, when the storm comes and the rush from the mountains washes out the fields and carries them to the seas, that the humus is going with it—the very thing upon which man lives and depends for a living, because all things eventually go back to the soil for a living. The brick blocks that are in this city, the brick blocks in Los Angeles and San Francisco, however high they may tower towards the heavens, come from your soil and mine—you and I, who dig in the soil. The relation of the soil to the fruit, we must have this humus. Potash we are rich in; they are poor. Potash is easily gotten—$60 a ton, a pound to the tree; about $30 to ten acres at $3 to an acre; but they only put on about 200 pounds to the ton in a two per cent high grade fertilizer—enough, as I will show you.

Now, I don't want to keep you too long. Nitrogen, phosphoric acid, potash—these things, which you see Professor Mackie said about the nitrogen. Look at it. Nitrogen! Humus is the storehouse. Look at the storehouse. Look at the supply. You have to buy it—buy it in green fertilizer or barnyard manure or nitrate of soda, and use them. Whatever else you may use, you must use that. But the time comes when you may have enough temporarily. But don't you go year after year or you will suffer; for the soil is depleted, and the soil is your bank, and the smaller the deposits the smaller the capital, and the less the income. Nitrogen is the thing that we need in our soils, and the relation of the soil to the fruit is not right unless you have more and more. See you now, the comparison of the bank again—the greater the deposit, the greater the income; the greater the capital, the greater the income; the greater the supply, the greater the dividends. Do you hear Chapman talk about dividends sometimes? Do you see his Valencias going out to the market at $3,300 a car? What he can grow with $10 you have got to put twenty in to get it, and it pays you, only your dividend is not as big.

Now, keep your bank full. See that your deposits are not overdrawn. See that the law is preserved in this soil, that the relation may be correct between it and the crop that brings the dividend. Buy nitrogen—you can hardly get too much. Perhaps I dwell too long upon that.

Now, the soil not only is the storehouse but it is the stomach. A sick stomach: a sick man, a puny man, a growling man. God help the

woman that has a dyspeptic husband. God help the orchardist that has got a dyspeptic soil. And lots of you have got it. You have made the stomach sick. The soil, as much as man, must be physically right. Why, it has got to be so open that the air can get into it, that the bacterial life may live and thrive and digest the food that is in it, and the food that you put into it. Therefore, the physical life of the soil must be right. It must be porous enough; heavy soil opened up with humus making material; light soils closed, too, with the same material, that the moisture conditions may be right; that you don't pour the water on and it runs off through the soil, or the summer winds rush through the soil like the winter winds used to sing around the corner of your father's house. An open soil lets the air rush through and away the moisture goes. You have got to have your soil so that you can hold the moisture, and that that uniform condition that Mr. Smith brought so clearly before you is attained.

I can show you in a ten-minute ride in my automobile where one is ruinously affected in two weeks after an irrigation; the other is never affected until eight weeks will expire, so that it is not pouring water on and taking it off.

Now, to keep the physical condition, get your humus and get your cultivator and use it, and use less water. More cultivator, less water. The cultivator is well said to be irrigation, cultivation, fertilization. Irrigation, hold what you put in and what the Lord put there from the heavens, which is worth more to you than what you put on through the ditch. Cultivation opens up the soil and lets the air go in to keep bacteria, and lets the noxious gases escape, as we open our windows to get the free air that we may live more healthy. Irrigation, cultivation, fertilization. Every cultivation you give your soil makes more plant food available ten times over than the cost of the work. Have you teams standing in the stable? Put them to work. Pay the man you have got, and feed the team. Pay the man day after day and day after day, that he may make our soil physically fit. Exercise it. It is the same as dumb-bells, as the rowing machine, as the football, the basket-ball, to the human soul, the tabernacle, this plain thing that we walk around in—we have got to keep it right so that we will be well. (Applause.)

Now, I will close, unless you have some questions. Again, let me say more than anything else, the key to the proper relation between the soil, with these elements in it, and the fruit which we are so hungry to see on our trees that we may get the money that we may make our wives and our children more comfortable—to get these you must be physically fit. Let me give you an illustration. There is a giant among men over yonder in Washington, physically fit, mentally fit, spiritually fit, with a soul so big that he can take all his fellows in. But look at the machine with which he hits so and wields the stick that brings salvation to the land. (Applause.) That is the thing we are after. We want a Rooseveltian soil, physically strong, physically fit to do a great work for you and for all. The more, the richer in plant food, the richer in physical life of the soil, the greater the income it will give you.

As an illustration, a gentleman who was here yesterday came to me a little over a year ago. I talked with him an hour about the

fertilization of his orchard, but he said, "We haven't the money. The lady for whom I work is a widow. She has lost her husband. She doesn't know how to finance. She doesn't like to go to the bank and borrow, lest not getting a crop she will lose her place." But I said, "My man, you can't get the crop without the food to grow it upon." "We haven't got the money, and we want to get the money." "Where are you going to get it?" "Out of the soil." "You can't. Haven't you tried?" "Yes, I have." And I preached and I preached as a Methodist evangelist preached, you know, in the old days back there. "Get religion, man—get religion, agricultural religion." And he got a little of it, and he went back to see the lady and I followed him, and I drove it home with all the force of my soul, because I saw the woman's salvation materially depended upon it, and her health of mind and body, and it is our soul that depends upon it, and we must see to it that if we have a message that we give it to them. And the man was here yesterday, and "Oh," he said, "what a revelation." And the woman said to me, "Mr. Mills, I have something to live for now. I have got the books you told me to get. I have dug into them. I have got them. I have got the message. I have got the gospel. I am going to live it, and my orchard is living it, too. The relation of the soil to the fruit. Keep the soil sweet and right, and it will work as you can if you are sweet and right physically. (Great applause.)

(At this time an adjournment was taken until 1:45 o'clock P. M.)

AFTERNOON SESSION—THIRD DAY.

THURSDAY, April 30, 1908.

PRESIDENT JEFFREY. As stated on the programme, Mr. Pease will have charge of the meeting, and I am going to ask him to preside this afternoon.

CHAIRMAN PEASE. Our first paper is by Mr. C. E. Bemis, "What is the True Value of a Certificate in Shipments of Nursery Stock?" I am pleased to introduce to you Mr. Bemis, Horticultural Commissioner of Los Angeles County.

WHAT IS THE TRUE VALUE OF A CERTIFICATE IN SHIPMENTS OF NURSERY STOCK?

BY C. E. BEMIS, OF COVINA.

I do not know whether those who assigned me this topic had in mind the current value of such a certificate issued under present conditions, and according to the practices now in vogue in the various states of the Union, or, its true value, if the best methods and men were responsible for its issuance.

Lest there be those present who do not understand the nature of these certificates, I might explain that about thirty of our states have passed laws which require a certificate of inspection to be attached to each shipment of nursery stock sent into such states. About ten of these states also require a certificate of fumigation. Several states accept the latter (if in the form of an affidavit) in lieu of the inspection certificate.

About seven states, including California, do not require these certificates, seven states and territories have no state laws. Now, the statements made in these certificates vary greatly in the different states. The different laws are just as variable in their requirements, according with their fears of this pest or that, few or many. Moreover, the methods used in the different states in making the inspections upon which these certificates are based, and upon which their true value must very largely depend, are still more valuable. A government or state entomologist makes the inspections and signs the certificates. In most states, the inspections are made chiefly for the discovery of San José scale; some attention being given to woolly aphis and to crown gall, little attention being given to any other kinds of infection, and only when the infections named are very bad are any stocks condemned. A few states have sufficient numbers of inspectors to make careful examinations of stocks, but in many states a single inspection officer has to cover all the nurseries of his state in from thirty to ninety days, once in each year, and all he need certify is that the stocks appear to be free from infection. Now, if any one of you Southern California inspectors, who are in the habit of spending weeks in the inspection of stocks from single nurseries, can imagine yourself examining all the nursery and florists' stocks in the State of California in sixty days, you can easily understand how little value would attach to your certificate in which you would state that you had inspected the stock in any given shipment, and it appeared to be free from infections. Florists' stocks are constantly being sent into California from many states bearing inspection certificates, but are, in many cases, found to be infested with various pests dangerous to our fruit industries here.

Our climatic conditions are such that many insect pests which can thrive only in the greenhouses of those states, may find ideal conditions here out in the open with almost endless variety of host plants ready for their attack. *Aleyrodes citri*, for instance, the dreaded Florida white fly, is now known to infest many greenhouses in the Atlantic and Southern States, and this pest may come to us in any of the thousands of shipments entering our State from those greenhouses, as the certificates attached give no assurance of careful or recent inspection. Strict quarantine measures are now directed against Florida and Louisiana only. I believe that a strict quarantine should be adopted and enforced by California against the importation of any and all nursery and florists' stocks from without her borders. We can, and should, grow all such stocks which we require. I am reliably informed that the Department of Agriculture at Washington is seeking to regulate all inspections and shipments of nursery and florists' stocks throughout the states by uniform and effectual laws. We should lose no opportunity to urge such enactments. However, by far the larger

numbers of trees and plants planted in this State are now grown within its borders, and the shipment of these is of greatest concern to us, as we have now many dangerous pests in various parts of the State which are not thoroughly disseminated, and their further spread should be vigorously fought against.

When I began this paper, I was under the impression that regulations similar to those of my own county were somewhat general throughout the State. I was very much surprised at being unable to find any other county reciprocating in kind. The rules adopted in 1901 by the Los Angeles County Commission require the inspection of all plants and trees shipped from within its borders, whether to points within or outside the county. A shipping tag must be attached, and a certificate of inspection mailed to the inspector at point of destination. Every inspector is forbidden to issue such a certificate unless he has made careful examination of the stocks. Our inspectors are, however, all human beings, and are therefore not infallible, so that some slight infections may pass them unnoticed, especially so, as Los Angeles is so great a distributing point for nursery and florists' stocks. Each inspector is required to examine every shipment coming into his district before allowing it to be planted, even though it bear a certificate from an adjoining district; and he must report at the next monthly meeting of inspectors and commissioners any infections he may find on such shipments, so that each inspector's work is under constant scrutiny of all his associates. All the railway and express companies readily coöperate with our commission in putting into effect our rule, which requires that no common carrier may receive for shipment within the county any plants or trees, unless accompanied by an inspection tag; and also the rule that the local inspector at point of destination, or the commission, shall be notified, on the arrival of every shipment, and delivery withheld for orders from such inspection officer.

Should every county in the State which ships trees or plants enforce a similar set of rules, the inspection certificate might become of immense value. The commissions of some counties with which I have had occasion to deal for some years, while the most exacting in their requirements against the least infection going into their counties, manifest the utmost indifference as to the condition of stocks sent out by them, apparently solicitous for the interests of their own nurserymen, but not concerned for the welfare of those who plant these stocks or for the general good of the fruit industries of our great State. The true value of the inspection certificate must after all depend upon the individual qualifications and integrity of the man making the inspection upon which it is based. Men possessing proper qualifications for this work are not easily secured, especially as places higher up are seeking such men, and are never fully supplied. Then too, the pittance allowed them for their services by our State law ($2.50 per day without expenses), does not make the occupation inviting to many of the best men, and its meagreness may be used in justification for neglect of duty by those employed. A stream never rises higher than its source, so the acts of our horticultural inspectors are not apt to rise superior to the incentives furnished them by those who appoint them, so that unless the policies adopted by the commissions of the various counties are the result of ripe experience, good judgment, and

sterling integrity on the part of each commissioner, and each shall insist upon their being faithfully enforced by their deputies, as well as themselves, the certificate has little value.

The horticulturists of the State must, through their organizations, and individually, demand of the county boards of supervisors, that the horticultural commissions must be taken seriously, and not classed with the dozens of other commissions created by our Legislature and by city and county governing bodies for no other purpose than to make places for the political supporters of those having the appointing power. Concerted action upon the part of our fruit associations and Protective League can require the selection of well equipped and reliable men for appointment to our horticultural boards, and our supervisors will not ignore our demands for such appointments. We have been too modest in our demands, and should begin to assert ourselves vigorously in such matters.

MR. ROEDING. In your paper you recommend that the fumigation of nursery stock should be carried on in nursery rows. How about nursery stock where the pest is in the roots of the stocks? In that event, the fumigation of nursery rows would not carry out the purpose you would want it to.

MR. BEMIS. Of course there would be a limit to its use, but I think, generally speaking, the greater part of the work of disinfection of our nursery stock can be accomplished by fumigation. We might find it more easy to disinfect them after being taken up, but in the case of phylloxera I don't know that we could gain anything by fumigating for that purpose at all, so far as I know anything about the practice adopted. I should presume, though, that in the case of many of those root forms, the remedies applied could be applied in the nursery row. That depends largely on what sort of treatment you use. If you use bisulphate of carbon, or anything of that kind, it might answer.

MR. ROEDING. It would not be practicable to fumigate for San José scale.

MR. BEMIS. For the reason that they would be below the surface of the ground?

MR. ROEDING. No, they would be above the surface, but the immense area.

MR. BEMIS. I don't know that that would differ materially from our treatment of red scale and that sort of pest that we treat on the citrus. We have found it very profitable to treat them in the nursery row. I don't know that we can economize room very much if we take them out and put them in a box.

CHAIRMAN PEASE. The next paper will be "Cause of New Infestations," by Mr. P. D. Fowler.

MR. FOWLER. Mr. Chairman, Ladies and Gentlemen: A number of years ago we were told by one of the experts at Washington that

the red scale would not live in this warm, dry climate of Southern California. Now, it has been demonstrated that it does live. We were told by him, and some others along about that time, that the white fly would not live in the dry, hot climate of the great northern valleys of this country. It was demonstrated last summer that it can live and does live. There was a time, years ago, when many people believed that even the white fly could not live and flourish in the valley of the great San Joaquin, but it does live. Not only that, but it has attacked the orange and the lemon. The lemon grows like the palm tree and flourishes like the cedars of Lebanon. So there have been some mistakes made by men who have preceded me, and should the commissioners of this State make mistakes they may yet get right.

CAUSES OF NEW INFESTATIONS.

By P. D. FOWLER, of Tulare.

This subject was assigned to me by the State Commissioner of Horticulture, and with the consent of this Convention, I will offer a few thoughts along this line. New infestations can be, and are, carried in many ways. A bouquet of flowers gathered in a beautiful flower garden, in which there existed some disease or insect, and carried in the hand or grip from one part of the State to another, could carry the same trouble to the place of destination. This has been done many times by both men and women without ever having given the matter a thought as to the danger. Men who live in this beautiful Golden State of ours have, while traveling through other states or foreign countries, seen some rare plant or shrub that excited their admiration, which they bought and carried carefully home and planted in their own garden. Later, they wondered why some peculiar insect or disease had developed in their garden. There are many things brought into this State that your commissioners never see, no matter how earnest, honest, and efficient they may be.

Insects and diseases peculiar to plant life are a great study. It requires a great deal of time, investigation, study, and experience to prepare a commissioner for his work. Trees, plants, and vines are shipped in all kinds of bales and boxes, and are often covered with mud, so that it is impossible to properly inspect them without washing every tree and plant; and when there is a carload of them there must be some work. There are constantly appearing new diseases and insects, and a commissioner must be a student full of energy, well applied, if he keeps up with the times. Many of the fruit growers of this State do not realize the benefits derived from careful inspection of nursery stock. The writer has been told many times by fruit growers that he had no right to go into an express office, or freight office, and open and inspect a bale of trees; but after full explanation of the necessity, and the law for it, the objectors were always satisfied.

New infestations may be carried by the shipment of boxes, ladders and picking sacks from one orchard to another, or from one county to another. There should be quarantine regulations. As I understand the laws of this State, the quarantine regulations are absolutely in the hands of the State horticultural authorities; and wherever there

exists a new and dangerous insect pest or disease, the extent of that territory should be ascertained and the district at once quarantined until cleaned up.

There should be no such thing as one county quarantining against another county. If there does exist in any county a dangerous insect pest or disease that is liable to be transported to an adjoining county, it is just as liable to be transported to some other county, and should be at once quarantined by the State. There is even more danger to the distant county than to the adjoining county, because the distant county may not know the condition existing. There should be a uniform system of inspection and quarantine, and then every commissioner, grower, and nurseryman should work to make it effective, by allowing only absolutely clean stock to be planted.

And, last, but not least, I consider the greatest danger of the new infestation is the distribution of nursery stock through the United States mail. A great deal of nursery stock is sent through the mail, and very little of it is ever inspected. Insects and disease can be carried through United States mail as safely as through the express office, but the inspector has not the same chance to get at them.

Five years ago the writer wrote to the Postmaster General in regard to the inspection of plants coming through the mail. An answer was received in due time. He said the question of inspection of plants coming through the mail was a new one, and that no ruling had ever been made in the matter, but that he would take it up with the department, and as soon as a ruling was made, would let me know. If there has ever been a ruling, I have not been informed. I have made some investigations about the matter, and have consulted the postmaster at San Francisco, and he informed me that there never had been a ruling that he has any record of. This is a matter of great importance, and should be taken up by this Convention. The Post Office Department should be earnestly requested to take immediate action, and make some provision by which all plant life coming through the mail could be inspected by the commissioners.

California has an absolute quarantine against Florida and Louisiana on all kinds of plant life; and yet, plants are coming direct from those states into California through the United States mail. Let us take some action in the matter.

MR. JEFFREY. Mr. Fowler has touched upon a very important point, and I think the Committee on Resolutions should get this matter before the Convention to be acted on to-night, if possible. I will say that this matter has been brought to the attention of the Post Office Department. The matter was referred to the Bureau of Entomology, and from the Bureau of Entomology to the Agricultural Department, and to Mr. Wilson himself; and I had a letter from him which concludes in this way, that he would dislike very much to see any restrictions put upon the free interchange of seeds or plants through the United States mails. The Post Office Department refuses to take any action. We were finally informed, after we had been notified that plants were expected through the post office, that our postmaster at Los Angeles was acting without authority in allowing us to reach those plants before they were delivered to the customers; and he noti-

fied us that hereafter, if we wanted to see any plants coming through the United States mail, we would have to wait until the plants were delivered to the consignees. The trouble is that the authorities at Washington don't view these things as do the people of California. It is a very hard matter to get the authorities at Washington to act. I would like Mr. Fowler to know that this matter has been carried up to headquarters and representatives in Congress have been seen about it, also leading men in Washington City. We have this letter from Mr. Wilson, stating that he would dislike very much to see any restriction put upon the free interchange of plants through the United States mails. Until they do see it, we will be at a disadvantage. I will say that we have been requested within the last week, as I stated to another audience the other day, to quarantine against the introduction of cotton seed into the State of California, on account of the boll weevil, and this came from the Agricultural Department. We all know that we never had such a good Secretary of Agriculture before. The system all down the line is a good one. In Mr. Woglum and Mr. Mackie you can see the kind of men they send out, but they do not see this thing as they ought to—this quarantine matter—and until they do, we will have an uphill job, and the greatest danger, as Mr. Fowler says, seems to be impossible to correct.

MR. FOWLER. I would like to say another word. Mr. Jeffrey has just said that the Agricultural Department is anxious for us to quarantine against cotton seed coming from Texas into California. Anybody knows that they can send cotton seed through the mail just as cheap and as quick as they can through the express office, or any other way. Our law requires that plant and nursery stock of all kinds being shipped through any source shall be plainly marked on the outside of the package, stating what that package contains, so that the inspectors will have an opportunity of getting hold of it. The United States mail don't do that. They send those things through without any kind of mark—with just the name and address of the individual to whom it is sent; and it is a hard matter for a postmaster to tell where they come from and who sent them, and where they were grown, and the commissioner has no chance to get at them at all, only by consent of the party to whom they are sent. The postmaster can tell you that there is a package there, which he thinks contains plants, and it is for so and so, and it will be delivered to him. Then you can see that party, and, if he will let you, you can examine the plant. I have burned up a great deal of stuff that came through the mails, but I have always done it by the consent of the party to whom it was sent. When I could get hold of a party that had anything of that kind and could talk to him, I could convince him that it was best to let me look at it, and if it was necessary to destroy it he would generally let me do it. I have burned up sacks of mail four feet high that contained nothing but plants, and they came from Florida. It is a condition that is very dangerous..

MR. SHARP. Did you examine them after they went to the consignee?

MR. FOWLER. Yes, I always examined them after they went to the consignee, but that don't give us the protection we want, because there are post offices scattered all through the country, and we don't know where the plants are going to. These things happen in the town where I live.

MR. ROEDING. I will only supplement the remarks made by Mr. Jeffrey by saying that I think the step which has been taken relative to the prevention of the introduction of cotton seed into this State is a good one, although I don't see where it makes any material difference to the fruit people of this State whether the boll weevil is introduced or not, because we are not in the cotton business, and it is not likely that we will be. Nevertheless, this wedge that he has introduced into the Agricultural Department on this one matter is certainly a very important point to the fruit growers of this State, and I think we should take active measures to support our Horticultural Commissioner, so that no stock can come through the mail without the Commissioner being aware of that fact.

The danger does not arise entirely from nursery stock which is shipped from different points in the United States, as far as California is concerned, so much as it does the importation of stock from foreign countries. The many pests which are known to exist in Australia, New Zealand, and Japan can readily be brought through the mail, particularly from those countries where the parcels post admits packages of from four to eleven pounds; and even more than this, the admission of packages of samples without value that are very rarely examined can come from all parts of the world, and growers who are not familiar with the dangers of the insect pests that exist in Africa and other places I have mentioned might, without any intention, do the fruit growers of California an injury, simply through ignorance. I have not the least doubt that the introduction of the white fly in California was brought about by packages brought through the United States mail to growers who had no idea of injuring the fruit interests of this State; but nevertheless, through the introduction of small packages, these pests were brought in. And were it not for the action of the State commissioners in regard to it, it might have ruined our entire interests.

There is not a year that I don't receive orange cuttings, and I invariably take active steps to wash those cuttings and fumigate them before I allow them to be grafted on the trees where we want to use them. This only illustrates how easily these things can be done without the officials being aware of it. A man does not desire it, and has not the slightest idea of doing the fruit industry of this State any injury.

CHAIRMAN PEASE. I think Mr. Jeffrey can explain the matter of the cotton boll weevil being introduced into the State. Oftentimes we have a pest introduced, and that pest does not confine itself to the same plants that it was a pest on in the country where it came from, and the quarantine against cotton seed would be from the fact that the boll weevil might transfer its attention to something that we have

here that it would like in lieu of the cotton, the same as the white fly transferred itself to some other plants when its food was all gone.

MR. JEFFREY. To-night, at the white fly discussion, you will find a chart showing about sixteen or eighteen food plants of the white fly in California, the *Aleyrodes citri*, the orange white fly. There are twenty-two species of plants on which the white fly has been discovered by our men at Oroville and Marysville, and that is one reason why the white fly makes so much trouble. If it should break out in Riverside or San José, or Fresno, or any other place where they have a large variety of exotic plants—imported plants—it would entail enormous losses upon the people in the destruction of their favorite plants. And I can see the boll weevil might adapt itself to other plants. At present we don't know that it would. At any rate, we want to keep the boll weevil out, because down here at Imperial there are a few men from Texas who are going to plant several hundred acres of cotton, and that is what brought this matter about. They don't want to plant anything but the particular Texas variety that they are familiar with, and don't want to bring their seeds in from South Carolina, or other uninfested districts; and it was to meet these men at Imperial that this quarantine was ordered. We have broken down the bars now—we have a formal application from the Department of Agriculture to quarantine the whole State against the introduction of a pest. Now, we ask them to assist us in the quarantine work which has been very recent, in regard to bringing in the new citrus varieties. The trouble here is that there is a conflict of jurisdiction. If you put postage on a package of plants, the postal law does not allow anybody to handle that except the man to whom it is addressed, and our quarantine is in direct conflict with that Federal law; for we pass a quarantine measure which would require our inspectors to go to the post-office and attempt to inspect the plants that might come by mail. Until these laws are reconciled, I don't see how we can prevent importations, unless it is by moral suasion on the Postmaster General, in which he will instruct every post office delivery clerk in the State to notify the inspector in whose district the office is located of the arrival of plants for a consignee, and give the inspector a chance to look at the plants before they are delivered or before they are opened. This is an enormous danger. The people of Marysville and Oroville have spent enough money fighting one little pest to pay the expense of the county horticultural commissions of several counties for several years, and if it should have broken out in Riverside the cost of its extermination would have paid the expenses of all the officers of the State for some time. If our Committee on Resolutions will take this up at the meeting to-night we will have something practical from Mr. Fowler's paper.

MR. WRIGHT. I have a statement which corroborates what has been said, that it is a constant danger which we are up against. I have here a catalogue of a nursery in Florida advertising seeds, and they publish testimonials. They prefix the testimonials which they have received during the year 1907 from the Pacific coast with a note, "Owing to the great agitation in California over the insects hereditary

on orange groves, we refrain from giving names to the following testimonials. The originals are, of course, on file." Then follows "San Diego, Cal., July, 1907. Samples arrived in fine shape. Please send the following order." And so on down through a long list—San Luis Obispo, Santa Barbara, San Diego again, Holtville, El Centro, Lordsburg.

Now, I happen to know—I have been in Florida and have seen the white fly in action, and I have seen this man's nursery, and it is located in the center of one of the districts where the white fly is most destructive. I assume from the fact that these shipments have been coming in in good order, and all through the year of 1907, that they have been consigned by mail. We are confronted with a continual shipment of orange trees from one of the worst districts in Florida for the white fly. Of course, I assume that there is no man interested in an orange grove, no man who knows the nature of these things, that would be guilty of such carelessness in the reception of such plants which may be infested; but, as Mr. Jeffrey suggests, we can by using some suasion with the Agricultural Department obtain the right to inspect or receive a notification from the post office that such packages are to be received. We will probably have repeated infestations of white fly bobbing up in every district in California to which these packages may be sent. I only bring this in in corroboration of what Mr. Jeffrey has said, that that is our great danger.

MR. JEFFREY. About two years ago a lady in Hollywood brought a bunch of plants over to the office and said that we could inspect them. We burned them, and she expected it when she brought them in. They were gotten from this same firm. We talked the matter over, and she said if she received any more plants she would let us know. Her husband got a letter from the Florida firm in regard to the quarantine, stating as follows: "We have no fear of detection"—that they had means of sending their plants into the State without marking or any means of identification, and not to pay any attention to the horticultural commissioners of Los Angeles County, that it was their business, and not the commissioners' business to interfere.

MR. CUNDIFF. Mr. President, Ladies and Gentlemen: We have heard the various questions relative to the cultivation and marketing of fruits very ably discussed by people from different parts of the State, who, I am sure, have demonstrated their ability to handle these subjects in a very entertaining and instructive way. The only regret that I have, as a Riverside, is that we have so few of our people here to have the benefit of these discussions. The business of fruit growing, while the greatest in the State, has its back sets and reverses and dark sides, the same as almost every other line of business. The business of the horticultural commissioner is largely on the dark side of it, or the pest side of it. You who were here the other day and were fortunate enough to hear the very able paper presented by Professor Cook, of Claremont, will remember that he referred to the damages in this State on account of injurious insects and plant diseases. I knew it was a large sum, but I had no idea that it attained anything like the proportions it does. I presume that Professor Cook has had the facilities for getting accurate information, and he places it in this State at fifteen

million dollars. An industry producing about sixty or sixty-five million, and damaged to that extent, certainly should elicit our interest and coöperation in order if possible to avoid or to remedy it.

At the last Fruit-Growers' Convention a similar subject was assigned to me. In fact, I don't know but that you are likely to get something similar to this at every fruit-growers' convention on quarantine. At that time, I went into the statistical part of the damages over the United States. I will not take up your time in this paper to discuss any of those features. That information is readily available through the department bulletins.

QUARANTINE BETWEEN CALIFORNIA POINTS.

By R. P. CUNDIFF, of Riverside.

The enactment of quarantine laws to protect our orchards against the introduction and spread of injurious insects and diseases had its inception in California, and the benefit to our horticultural interests through the work of our quarantine officials at San Francisco, and other ports of our State, in preventing the introduction of destructive insects and plant diseases, is one of the principal safeguards to the future welfare of our State's greatest industry.

The subject under consideration, "Quarantine Between California Points," we shall assume to refer to intercounty shipments or nursery stock, fruits, etc. The legislative enactment approved March 25, 1903, provided for a State Commissioner of Horticulture, who shall also be quarantine officer. Such officer may, with the approval of the Governor, establish, maintain, and enforce such quarantine regulations as may be deemed necessary to protect nurseries, trees, plants, vines, or other articles of horticulture against contagion or infection by injurious disease, insects or other pests, by establishing a quarantine at the boundaries of the State, or elsewhere within the State.

The law confers no authority upon the Commissioner of Horticulture to regulate intercounty shipments of nursery stock, fruits, etc., except where such shipments are consigned to counties or localities having no legally appointed county horticultural officials.

The law also provides for the appointment of county boards of horticulture, to consist of three members. While the law clearly defines the duty of the county horticultural commissioners, it does not delegate to them power to enact quarantine regulations. Such laws must be enacted by the boards of supervisors in the form of county ordinances.

In some instances these ordinances have been criticised and ridiculed by nurserymen and others interested in the sale of nursery stock. We do not take the position that all of the county horticultural ordinances of California are perfect, but we believe, in the main, they will compare very favorably with the general legislative enactments of the State. The claim has often been made that counties have no power to quarantine against other localities, but must accept any nursery stock offered for sale upon which dangerous pests or disease can not be located by an inspection. While it is true that in at least one decision, rendered by a superior judge of the State, apparently affirming the

view taken by the nurserymen, it does not destroy our belief that had the case gone to a higher court the decision would have been reversed. Law is supposed to be founded upon justice and common sense. The right to protect both life and property is as old as civilization. The Legislature of our State, in defining the duties of county boards of supervisors, names as one of their duties, "to make and enforce within the limits of their county such local police, sanitary, and other regulations as are not in conflict with general laws," hence there can be no doubt as to their authority to enact and enforce laws to protect our horticultural interests from the introduction into their counties of injurious insect pests or plant diseases.

The want of a proper understanding or appreciation of this work by some of the county boards of supervisors of our State has been one of the most discouraging features, and has prevented the protection to our horticultural interests to which they are entitled.

The practice, in some counties, of making the appointment of horticultural officials political rewards, has resulted, as might be expected, in placing men in these important positions who possess no qualifications or fitness for the work. Until this practice is absolutely discontinued it matters but little in such counties how effective may be their ordinances; unless the officials, whose duty it is to enforce such laws, possess a proper appreciation and understanding of their work, the results will continue to be unsatisfactory.

The expense of fighting insect pests, plant diseases, etc., is continually increasing in our State. What can be done to prevent this, and how shall we accomplish it? We believe that a rigid enforcement of proper quarantine regulations in intercounty shipments of nursery stock will do more than all other agencies to solve this vexing problem. "The pests we keep out can do us no harm," should be the watchword of every horticultural official. "An ounce of prevention is worth a pound of cure," can be applied to keeping injurious insects from our orchards with a hundredfold greater meaning than is usually applied to this time honored adage. The quarantine department, under the supervision of our State Commissioner of Horticulture at San Francisco, is doing a splendid work in preventing the introduction into our State of new insect enemies and plant diseases. So efficiently has this work been performed that I can recall no instance of a new pest gaining admission to our State since the establishment of this important office, over twenty years ago, except the white fly. The orchard pests we are battling with, and are costing such large sums of money to combat, were firmly established in our State before any preventive legislation was enacted. Therefore, the responsibility for the continued spread of these pests from one locality to another must rest largely with the county horticultural officials.

In this connection, I wish to say that there are many worthy and absolutely efficient horticultural commissioners whose efforts along this line have been greatly retarded for want of proper encouragement from their boards of supervisors in the way of adequate financial assistance. This penurious and shortsighted policy, in some counties, has allowed the pests to gain such a foothold by spreading from orchard to orchard that the cost of producing marketable fruit is a very serious

drain upon the income of the fruit grower. The fruit grower is largely responsible for such a condition existing in any county. He should demand the protection to his orchard and locality to which the law entitles him, by insisting that only the best men be appointed as horticultural officials, and that they are furnished with the needed financial assistance by the supervisors to properly carry on their work.

There are various conditions that must be taken into consideration in preventing the introduction of injurious pests from other localities. First, the nature of the pest should be understood; its resistance to remedies for its destruction should be known. Unless you are positively sure that you can apply a remedy that will absolutely destroy it, you had best take no chances in releasing it to the consignee; better to burn it, and if necessary, have your county pay for it, than take chances of allowing a pest to become established that may cost many thousands of dollars to even control. As an illustration, we will name the purple and red scale; either of these varieties are exceedingly resistant to any known remedies for their eradication. Others might be named equally as difficult to destroy. We know of no instance of either an insect pest or plant disease ever having been eradicated after gaining a foothold in any section. Perhaps the nearest approach to this has been where we have been so fortunate as to find the true parasite or insect enemy of some of our scale pests. The cottony cushion and San José scale are perhaps the most notable examples of the absolute control by parasitic enemies. Both of the above varieties of scale were at one time classed as among our most destructive pests, as well as being exceedingly resistant to artificial remedies for their eradication. With all of our experience and improved methods, such as fumigation, spraying, etc., we are only able to control the ravages of destructive insects after becoming established in any locality. Any artificial remedy is expensive, as it must be applied at regular intervals, owing to the impossibility of destroying all of the insects at one application.

We are opposed to placing unnecessary restrictions upon nurserymen or others interested in the sale of trees, but we are unalterably opposed to allowing pest infected or diseased trees brought into any locality. No dealer in trees should have either a legal or moral right to send out nursery stock infested with destructive pests, and no purchaser should have the privilege of planting out such stock to spread the infection and become an expensive menace to the horticultural interests of his locality. Upon this point there should be no clash between the honest nurseryman and the horticultural official. The nurseryman who is so unfortunate as to have diseased, or pest infected stock, should have no right to visit his misfortune upon other localities. In our experience, as horticultural officer, we have usually found those engaged in the nursery business men of integrity. This is especially true of those who are depending upon the business for a livelihood. It is the man who is known as a tree broker, or the person engaged in the business as a side issue, that we must beware of. It is often true that blame should attach to the intending purchaser quite as much as to the nurseryman for the introduction of new pests into a locality. This is especially true of the newcomer, who is perhaps absolutely ignorant of the existence of injurious orchard pests. After securing his land,

he naturally goes into the market to purchase his trees where they are offered the cheapest. Usually the cheapest places are in sections where the pests are the most in evidence. If, perchance, he notices the scale or other insects upon the trees, he is blandly informed that they are of no consequence and can not live in the neighborhood where he expects to take them, besides they have been thoroughly fumigated, and there is absolutely no danger of any spread of the pests from the trees, etc.

We have frequently had very unpleasant experiences in condemning stock under conditions as above represented. Another class of purchasers that must be closely watched is the speculator, "the get-rich-quick fellow," who expects to plant out a new tract and unload it on to some tenderfoot at the first favorable opportunity. He is generally on the lookout for cheap trees, and is often loaded up with scale infested stock from some quarantined section, unless the horticultural official is fortunate enough to get an interview with him before such a mistake is made.

As to the value of quarantine regulations, we trust we may be pardoned in referring to this county to substantiate our claim as to the wisdom of this method for the control of insect pests. We absolutely refuse to admit stock from districts known to be infested with any serious pests that have not been introduced into our county. We also refuse to admit nursery stock infested with red scale, though we are expending quite a sum of money annually to control this pest in our county. We are bending every energy to prevent it gaining headway in new orchards and clean districts of our county. The pests we have in this county were firmly established before a horticultural commission was ever appointed, and before such remedies as fumigation were known. By our system of quarantine and inspection we have been able to keep out such pests as purple scale, silver mite, phylloxera, and white fly, as well as others of less importance. In referring to the above, our present board of horticultural commissioners does not wish it to be understood that it was the originator of this valuable precautionary work. The credit belongs to our predecessors in office, as it has been the policy since the formation of the first board of commissioners of our county. The present board has simply extended and improved the quarantine from time to time, as appeared to be for the best interests of our fruit industry.

What other method but an absolute quarantine could prevent the introduction into any locality of such pests as the white fly, phylloxera of the vine, purple scale, silver mite, and Morellos orange maggot, as well as many other serious pests that could be named? It matters not how carefully we may inspect or what remedies we may apply to nursery stock coming from infested localities, if continued for any length of time, it is sure to result in the pests being admitted into otherwise clean districts.

As horticultural officials, it is our duty to use every precaution to prevent the further spread of injurious orchard pests. An industry that represents an income to the State of nearly sixty million dollars annually should be entitled to and receive the greatest possible protection. To this end the horticultural official should have the active coöperation and earnest support of every fruit grower and taxpayer of the State.

MR. ROEDING. I really believe that it would be far better for the horticultural interests of this State if our State quarantine officers regulated the districts which would be quarantined. I think all the horticultural commissioners fully realize that it is very difficult, indeed, to draw an imaginary line between counties. In quite a number of counties in Southern California no grapevines are permitted to come from certain places. If the commissioner from Fresno County makes the report that the vines which had been raised from cuttings had been grown in a district where phylloxera is not known to exist, those vines are allowed to come into this county. San Bernardino County under no consideration allows vines to come from a district north of the line of San Luis Obispo and Kern counties. The counties north of the line mentioned are permitted to ship vines into Los Angeles County, with the proviso that they notify the horticultural commissioner, and also that they can only ship these rooted vines to a grower. They are not permitted to ship them to a nurseryman to distribute them in small lots where it is impossible for the horticultural commissioner to keep them under his observation. Under these regulations we have been shipping vines to Los Angeles and San Bernardino counties. It is not at all unlikely that if those vines are infested with phylloxera, that that insect will get over the imaginary line between Riverside and San Bernardino counties. So, it seems to me, the best interests of this State demand a uniform horticultural ordinance, so that where a dangerous insect pest is known to exist, the State Commissioner can use his judgment as to whether a shipment shall be made from one county to another. I don't want to expose trade secrets, but I might say that I can ship vines to San Bernardino County if I want to, and there is no way to follow it up. If my vines should come from Bakersfield, the commissioner would not pay any attention to them unless he happened to know they were from me, and that I did not do business at Bakersfield. I will say that I have no intention of running any game of this kind on the people of San Bernardino County. It merely illustrates how easy it is to put these things in.

MR. HARTMAN. I don't believe that there is any physician in the State that is capable of looking into my face and telling whether I have ever been exposed to scarlet fever, or anything else, but if he knows that I come from an infested district, that is enough. Mr. Roeding does a great business, and of course has to trust to employés to do part of it. How do we know what his employés will do?

MR. KING. Many of the conditions are brought about through ignorance. While the discussion was on with relation to bringing in plants to California, my mind went back to my advent to California three years ago, my wife having come here two years previous to that to look after our interests here. At one time my wife and another woman thought it wise to send to Florida for some plants. They had no idea that they were violating any law. The plants came in, and I believe they were perfectly healthy, but they ran the same risk as everybody else does. Now, I feel that it might be wise to have our rep-

resentative furnish detailed information on these points to the newcomers coming in from the East. It might help us in a great many cases, and it might have prevented even the white fly's introduction.

MR. JAMES MILLS. Mr. Chairman: Just a word. I am very greatly interested in this discussion and in the views that are being expressed. Yesterday, I think it was, Mr. Roeding said he was sorry to say he was a great sufferer from the laws as passed by some of our counties. I thought when I looked at him, and when I heard and knew his success, that he was a very healthy looking sufferer. Now, it is not a question of Roeding or Mills or Teague or any other nurseryman's welfare; it is a question of the welfare of the growers at large. I am one of those who have a nursery, who believe in drawing the line just as close as it is possible to draw it, and to compel those who raise stock to clean up and not allow them to ship goods into other sections not affected with like diseases and like pests.

I have in mind a party who wanted to ship into this county a few years ago 3,000 trees at ten cents a tree. The growers here wanted them, and were put out at the commissioner because he said no. The nurseryman said, "I am willing to pay the damage. What is it?" He said, "It is $10,000. Do you want to pay it?" And the result is that we have not got purple scale. It was from a purple scale district.

This year the growers in Riverside raised the question. We want this embargo lifted; we can't get trees. And let me tell you that the growers wanted to go into the purple scale districts, into the red spider districts, to import trees into this county where we don't have it, and the men from those distant districts from which our growers wanted to import came into this county and purchased trees to go down there. I have sold myself thousands of trees this year that went outside the borders of this county; and our people want to go outside the borders of this county to bring trees in.

I am one of those who, having large interests in my hands for others, am ready to put my hands in my pocket and form a company to grow stock for the growers of this county at cost, rather than to bring trees in from other districts where they have these diseases. God knows we have enough. I myself am responsible in twenty months for an expenditure of $57,000 in fighting the scale here in a small district in this city. Shall we, the growers, earnestly seeking our welfare and the welfare of our families, endanger for the welfare of one nurseryman, or two, or three, all of us? I say no. (Applause.) The individual must give way to the masses. Let us get county ordinances; let us get State laws; let us get national laws on these great fruit interests involving such enormous capital and labor. (Applause.)

MR. SHARP. I feel a little delicate always in talking about what we have done in our county, or what I propose to do or what I don't propose to do, or anything of that kind. I want to say this, that the best thing we have found is to educate the people to believe that they can't afford to go outside of the county to get a tree or vine, that they can raise them at home, and they will grow there all right.

CHAIRMAN PEASE. I remember when this purple scale question first came up that there was a nursery firm from Florida that were shipping citrus nursery trees from Florida all over Southern California. They were shipping many carloads to Pomona, where I lived at that time, and the local inspector found the purple scale and was inclined to burn them up. The man who shipped them was indignant, and he said that was absolutely unnecessary. He said, "The purple scale will not live in this locality, and if you will plant them out in your orchards I will give you five dollars for every one you find alive after two years." I believe he also said that he would eat them. I am sure that that man could go through the counties of this State and get a very square meal on the purple scale.

I have had nurserymen tell me that there was no use in trying to keep them out, that they would get in any way. And in line with that point, showing that they thought the scale would not live in this climate, I want to quote a funny little piece that you will appreciate. It is from the State Horticultural Report of 1884. It is in reference to the black scale. You can hear this same story told in the upper parts of our county now. They tell you it won't live in this climate. They said the same thing about the red scale; they said the same thing about the white fly; they said the same thing about the purple scale. I want to show you what the State Entomologist said in 1884:

> The black scale is the most universal scale, and has been known by all citrus fruit and olive growers of the State who have trees within reach of certain influences from coast climate and winds. These limits do not extend by miles from the coast, but by these peculiar influences referred to. It has now been fully established that this black scale (*Coccus oleæ*) will only thrive under certain favoring influences, and that remote from these, in the hotter and drier interior climates, it will die out even after being introduced on living transplanted trees.
>
> To illustrate this fact, trees infested with this scale have been taken to the interior hot valleys, and have been, after a season, found to be free of scale. I have found this to be the case at Riverside, and other portions of San Bernardino County. During a late visit to Ontario, this fact was brought strikingly to my notice by Mr. Chaffey, who showed me orange trees planted last spring, and upon which a few black scale remained; by their side trees planted a year previous to these, and which, although at time of planting were infested, had now become clean; also at Pomona, one of the choicest spots in the State for citrus fruits. Mr. Frank House, in kindly showing me the orchards of that favored locality, proudly called attention to the fact that no pest existed there upon their citrus trees or fruits. It is at this place, a few miles from its western boundary, that this exemption from the presence of the black scale begins, and nowhere east of that boundary can this scale thrive. It is here that the olive first shows the beautifully bright and clean appearance so characteristic of that tree in its perfect health. This exemption results in the greatest fruitfulness, as I saw demonstrated by the inspection of trees at Pomona, Ontario, and Riverside.

MR. MILLS. We have enemies enough to fight in Riverside, and the way to preserve us from any more is to draw the line like a wall. We desire to protect ourselves from the future. We must go to Sacramento soon to get more guards at all the ports of entry on the Pacific coast, at all the places in the south along the railroad lines, and down into Mexico, that we may not get the Mexican worm; that we may not get the fruit worm of the Mediterranean; that we may not get many enemies that are seeking entry here, and that would devastate all our orchards and cause incalculable loss. We are here to protect the vast interests we have, and the interests that give us our living. Let us be protected, and let us demand it as fruit growers. We have been neglecting it, we have been denied our rights, because we have been a miserable lot of

creatures. We have not sought our rights. We are the voters, and if we ask to be heard we will get protection. We need it, and we should go after it.

The Chairman here announced the evening session, which was to be devoted to an illustrated description of the white fly campaign, and the session adjourned.

EVENING SESSION—THIRD DAY.

Thursday evening was devoted to a lecture on the work done against the white fly (*Aleyrodes citri*) at Marysville, Oroville, and Bakersfield. This was illustrated with a long series of stereopticon views, showing the necessary destruction of the citrus trees and other food plants of the white fly in the affected districts. These views were described by Mr. E. K. Carnes, under whose direction the work was done. There was a very large attendance present, and the views impressed upon the orange growers of the State, more than any words could have done, the sacrifices which have been made by the people of the affected sections to preserve the great orange industry of the State from destruction.

Upon conclusion of the lecture a number of questions bearing on the subject were asked, after which an adjournment was taken until Friday, May 1, 1908, at 9:30 o'clock A. M.

PROCEEDINGS OF FOURTH DAY.

FRIDAY, May 1, 1908, 9:30 o'clock A. M.

PRESIDENT JEFFREY. Mr. E. W. Holmes has a little statement to make about the Riverside navel orange, the premium orange of the world.

MR. E. W. HOLMES. Upon the opening of this Convention, your Chairman, in a jocular way, made reference to a statement which had been considerably circulated, and which did injustice to horticulturists. I have asked permission to make a statement in regard to that so there might be no misapprehension about it.

I happened to be one of seven or eight pioneers who planted the first orange of the navel variety. Only three of that number are now living. Up to that time we were groping in the dark, and had no knowledge what was best to do. We did not know whether we could enter the markets against the Florida orange. A few years after that, the fair at New Orleans was held and it was decided to make an exhibit there of our oranges. The result was that the Riverside exhibit at the fair won the two gold medals and the silver medal for the best exhibit of oranges and the best exhibit of lemons grown, against Florida and the world. The statement has been made many times that it was a mistake to say that the prize was won by the Washington navel, as we call it. That statement is a mistake. It is true that there were many Australian navels taken in, because in the largest exhibit we took all varieties, Australian and bloods, and everything else, and several varieties of lemons; but the award was really based upon the superior quality of the navel orange. It was a great surprise to the Eastern people at that time that California should venture to enter the race with Florida, and should overcome it in its own field.

PRESIDENT JEFFREY. We will now hear from the Committee on Resolutions.

Resolution Favoring the Appointment of County Horticultural Commissions.

WHEREAS it is possible that confusion or conflict may obtain through the possibility of some counties appointing a horticultural commission under the County Government Act, instead of under the State law authorizing the appointment of a regular commission of three members, and the lack of such county commission may embarrass the State Commissioner in properly safeguarding the horticultural interests of the State and enforcing quarantine; therefore, be it

Resolved, That the best interests of the State demand that every county should promptly comply with the State law and organize a regular commission of three members, and not proceed in any other way, thereby strengthening the work of the State Commissioner of Horticulture in preventing the introduction or spread of dangerous insect pests or diseases.

Respectfully submitted.

A. V. STEUBENRAUCH.
C. B. MESSENGER.
H. C. ROWLEY.

Resolution Indorsing the Campaign Against the White Fly.

WHEREAS the work of the State Commissioner of Horticulture, in taking up the work of stamping out the white fly pest, has been most energetic and most effective service has been rendered; therefore, be it

Resolved, That the State Commissioner of Horticulture and his corps of assistants are worthy of commendation and the fullest support from every fruit grower in the State; and be it further

Resolved, That this Convention urges that the State Legislature make more liberal appropriations for this office.

Respectfully submitted.

A. V. STEUBENRAUCH.
C. B. MESSENGER.
H. C. ROWLEY.

Resolution Indorsing the Work of G. Harold Powell.

WHEREAS the results accomplished by the Secretary of Agriculture in detailing Mr. G. Harold Powell and his corps of assistants to investigate the causes of losses in citrus fruit shipments through decay, have resulted in the saving of vast sums to that industry and in encouraging its extension; therefore, be it

Resolved, That this Convention most heartily indorses this work, and urges its continuance and extension to deciduous fruits, grapes, and vegetables.

Respectfully submitted.

A. V. STEUBENRAUCH.
C. B. MESSENGER.
H. C. ROWLEY.

Resolution Indorsing the State University and Professor Wickson.

WHEREAS the University of California Experiment Station is rendering a most valuable service to the horticultural interests of the State in many and sundry activities in all sections; and

WHEREAS Director Wickson and his able staff are deserving of the hearty support and commendation of the fruit growers of this State; now, therefore, be it

Resolved, That the approval and indorsement of this Convention be, and is hereby, given the University and Director Wickson.

Respectfully submitted.

A. V. STEUBENRAUCH.
C. B. MESSENGER.
H. C. ROWLEY.

Resolution in Favor of Inspection of Plants Passing through the Mails.

WHEREAS the transmission through the mails of seeds and plants from quarantined sections of the country endangers the farming interests of this State by bringing into California seeds and plants which may be infested with dangerous pests and diseases; and

WHEREAS no inspection is allowed by the Post Office Department of such mail before delivery of the package; therefore, be it

Resolved, That the Secretary of this Convention call to the attention of the Post Office Department and the Department of Agriculture the dangerous possibilities of this situation, and urge, as the sense of this meeting of fruit growers of California, the serious conference of the two departments, with a view of arriving at some means of overcoming this danger.

Respectfully submitted.

A. V. STEUBENRAUCH.
C. B. MESSENGER.
H. C. ROWLEY.

Resolution Favoring Woman Suffrage.

Resolved, That we favor the submission to the qualified electors of the State of a constitutional amendment providing for the extension of the suffrage to women on equal terms with men.

Respectfully submitted.

A. V. STEUBENRAUCH.
C. B. MESSENGER.
H. C. ROWLEY.

Resolution of Thanks.

WHEREAS the success of any public convention is due, in large measure, to the efficiency and skill of the local committee of arrangements, in preparing in advance the conveniences and material for the work and pleasure of the meeting; and

WHEREAS the Thirty-fourth California Fruit-Growers' Convention is, in large measure, indebted to the Committee of Arrangements of this occasion, Messrs. Mills,

Reed, Holmes, Chase, and Ramsey, assisted by Mr. May, Secretary of the Chamber of Commerce, for the successful accomplishment of its duties; now, therefore, be it

Resolved, That the thanks of this Convention are sincerely voted to these gentlemen.

Resolved, That a vote of thanks be, and hereby is, tendered to the Woman's Club of Riverside, for the very enjoyable entertainment provided for the members of the Convention on Wednesday evening, this also to include all who took part in the programme on that occasion.

Resolved, That a vote of thanks be, and hereby is, tendered to the citizens of Riverside who so generously provided such a desirable and convenient meeting place for the Convention.

Resolved, That a vote of thanks be, and hereby is, tendered to the press of the State for the work done in promoting the Convention, by timely notices in advance of the meeting, and also to the local press for the full reports published of the proceedings of this Convention.

Respectfully submitted.

A. V. STEUBENRAUCH.
C. B. MESSENGER.
H. C. ROWLEY.

On motion of H. C. Rowley, duly seconded, the above resolutions were unanimously adopted by the Convention.

PRESIDENT JEFFREY. The Committee on the President's Address will now report.

Report of the Committee on President's Address.

To the California Fruit-Growers' Convention:

Your committee desires to submit the following report and recommendation on the President's semiannual address for your careful consideration:

This address is deserving of the closest attention on the part of our fruit growers, as our interests accordingly represent [illegible] annual income to our great State equal to the income of any other industry.

Our President has presented, in his address, an array of facts, which show, conclusively, that although our fruit growers are contributing more money in the way of taxes, and doing more to add to the wealth of the State, that the legislative branch of our government has not made appropriations in keeping with the proper prosecution of his work.

We most emphatically recommend that our fruit growers use every effort in their power to impress the members of the next Legislature, from their respective districts, with the necessity of making liberal appropriations for the benefit of our vast horticultural interests, so that the efficiency of the working force, so ably guided by our President, shall not be hampered in its investigations on account of the lack of funds in this laudable work.

We desire to commend the efforts displayed by our President, and his efficient corps of deputies, in their prompt and effective work in exterminating the white fly (*Aleyrodes citri*) in such localities where reports were received of its existence.

It is needless to say that we fully understand the importance of continuing this work along the lines which have been followed, but that we have not been sufficiently roused to the fact that unless more funds are provided for the conduct of this office, that the efficiency which we expect from these officials will not be realized.

At our semiannual convention we should aim to aid our President in his efforts to accord all those who are invited to address us the time allotted to them for the proper presentation of their papers, and the discussions which are to follow.

We recommend that a copy of this address be placed upon the desk of each member in the halls of the Legislature at the next session, so they will have an opportunity of learning for themselves the importance of the work which is being done in our interest. Further, that the Committee on Legislation shall, by personal solicitation, do everything in its power to have the appropriation for our horticultural interests increased in keeping with our needs.

J. H. REED.
C. E. BEMIS.
GEO. C. ROEDING.

On motion of George C. Roeding, duly seconded, the report was adopted as read.

MR. MILLS. I move you that the Secretary of our Convention be instructed to forward through the United States mail a copy of the President's Address, so soon as it shall be known after election who

the members of the next Legislature are, to every member of that Legislature.

Motion seconded, and carried.

PRESIDENT JEFFREY. We will now have the pleasure of hearing from a practical orchardist, a man of large orchard affairs. "Maintaining the Fertility of the Orchard," by Frank L. Palmer, of North Pomona.

MR. PALMER. On Wednesday, a gentleman was introduced to me at the hotel, who said he was particularly glad to meet me, as he noticed that I was to have a paper on fertilization, which he would very much like to hear, but would not be able to remain over until to-day. He said that he had made investments in orange property, and was going to make other investments in orange property in other parts of the State, and under the circumstances would I not just tell him in a word which is the best brand of fertilizer. (Laughter.) I will simply say if the gentleman had waited over he would probably have been very much disappointed in my paper.

MAINTAINING THE FERTILITY OF AN ORCHARD.

By FRANK L. PALMER, of North Pomona.

We have heard a good deal in recent years about worn-out and unproductive farms. About the year 1890 these so-called "abandoned farms" of New England came into special prominence by reason of the fact that some of the New England states issued lists of such property for sale — these lands having been sold to the State for unpaid taxes. The title of the pamphlet issued by the State of Massachusetts was this: "Descriptive List of Farms in Massachusetts Abandoned or Partially Abandoned." Connecticut, New Hampshire, and Vermont issued similar lists, and in a State report for Maine the large number of 3,398 such farms is mentioned.

Unproductive farms are not confined, however, to the New England states. We know, as a most serious fact, that the once rich prairies of Illinois, and other states of the wheat belt, have become so impoverished by continuous cropping that the land is now yielding less than half the number of bushels of wheat it produced forty years ago. Many farmers of Illinois grew wheat upon those fertile lands year after year until wheat could no longer be profitably grown, then they moved on to Nebraska and the Dakotas and repeated the process, and the same class of farmers are still moving on to seek virgin soil in Manitoba.

Such is man's wasteful method. But let us turn for a moment from man's methods to nature's methods. In a state of nature do we find land worn out by reason of its having been taxed with a heavy growth? The early American pioneers pushing their way toward the West, cutting out forests, clearing timber lands, and converting them into farms, did not find this land impoverished because it had been growing and nourishing a forest. No; in nature fertility is maintained by nature's own processes. "In nature those elements of fertility which

have been withdrawn from the soil by plants in their growth are returned to it by their death." In the case of the forest lands, the original fertility of the soil has not only been maintained, but vastly increased by the decay of leaf mold and other vegetation, and the subsequent formation of humus in the soil. Here, then, we perceive the working of a natural law of replenishment or restoration. This law, ordained by the Maker of the Universe and observed in nature's own processes, must be obeyed by man. We must restore to the soil those elements that we remove from it in crops, or, failing to do this, we shall bring poverty upon ourselves and upon those who are to follow us.

All these facts are perfectly familiar to us. There is no need, before an audience like this, to make any argument to emphasize the necessity of fertilization of our soils. We recognize the necessity; we are willing and even anxious to obey the law of restoration; but when we fertilize our farms and our orchards, we desire to do it wisely and intelligently; and we find the subject hedged about with some difficulties, and containing problems still unsolved.

It is an interesting fact that it was only about one hundred years ago that the sources of plant food began to be correctly understood. Professor Snyder says, in the introduction to his admirable book, that, while manures had been used from the earliest times, and their beneficial effects recognized, their action was regarded as mysterious, so much so that the alchemists preached a theory that so-called "spirits" left the decaying manures and entered into the plant, thus accounting for its more vigorous growth. Continuing, he says that among the first to see the relation between chemistry and agriculture was Sir Humphrey Davy, who published a treatise on the subject in 1813. Since that date vast strides have been made in the proper understanding of the composition of plants, and of the sources and composition of plant food. Years of study and investigation have been given to the subject by eminent men of many countries, and through the investigations and extensive field experiments carried on by such scientists as Von Liebig, in Germany, and Lawes and Gilbert, in England, the world at large attained much of its enlightenment which forms the basis of our present day knowledge of these subjects.

Coming down to our own time, and to the present day, I think it may be confidently said that a distinct advance has been made in our orchard practice by us farmers here in Southern California, during the past twenty years. Fertilization is practiced much more wisely and intelligently, I feel sure, than it was fifteen or twenty years ago. In no respect is this more true than in the general awakening to the value and importance of humus.

HUMUS.

Humus has been aptly described as the "life of the soil," and this is true in a very literal sense, for it is the home of the bacteria of the soil, those wonderful little organisms which convert the inert fertilizing elements into forms which are available as plant food. When the humus of a soil becomes exhausted, or burned out, these microorganisms cease to do their work; and under these conditions our trees may be insufficiently fed even though a plentiful supply of fertilizers

may have been applied; and this because of the fact that the free roots can not take up fertilizers in the forms in which we apply them. Almost all the fertilizing elements that we use have first to be converted, by the action of the soil bacteria, into other forms that are available to the tree.

What are the conditions here in Southern California? We have a semi-arid region. Our soils contain, as a rule, plenty of lime and potash, but are very deficient in humus and nitrogen. It thus becomes of vital importance that we conserve our humus supply, and add to it in every feasible way. I consider that for our arid region the basis and foundation for all successful fertilization is the maintenance of a supply of humus.

How is this to be done? I know of only two ways. One is by liberal applications of stable manure, or straw, alfalfa hay, or other mulch, and the other is by the growing and plowing under of cover crops.

STABLE MANURE.

The fertilizing effect of stable manure is far in excess of what we would expect from simply studying the amount of plant food contained in the manure. Dr. Wiley of the Agricultural Department has this to say on that point:

> The action of stable manure is another instance of the great benefit which is derived from manuring a field with nitrifying organisms. It is well known that the nitrifying ferments of decomposing stable manure are particularly numerous and vigorous. It has long been a matter of wonder among agronomists to find stall manure, when scattered over a field, producing fertilizing results far in excess of what could be expected from the quantity of plant food contained therein. In the light of the facts set forth above, however, these results are no longer surprising. In the distribution of the manure large numbers of a particularly vigorous species of nitrifying organisms are incorporated with the soil, and these and their progeny continue to exercise their activity upon the inert nitrogen of the soil when the more easily nitrifiable portions of the stall manure are exhausted.

Let us, then, use stable manure, and accord to it the high appreciation that it deserves. It is a most valuable fertilizer, particularly for use in old orchards, where, owing to the size of the trees, it is difficult to grow cover-crops successfully. Before leaving the subject I desire to add, however, that I do not regard the *exclusive* use of stable manure as desirable. It is a one-sided, unbalanced fertilizer; being rich in nitrogen as compared with phosphoric acid and potash. In its action it will combine with its nitrogen the available potash and phosphoric acid already in the soil, and year after year the available supply of these two constituents will become less. A bulletin of the New York Station cites the fact that the soil of many farms in that State has actually become exhausted by this process, where the exclusive use of stable manure has continued for long periods of years. Therefore, when using stable manure continuously, it seems to be evident that we should use some form of potash with it, and possibly both phosphate and potash.

COVER CROPS.

I mentioned the use of stable manure and the growing of cover-crops as the two best methods for maintaining the requisite supply of humus in the soil. Cover-crops easily rank first in this particular; and, besides

furnishing a supply of humus, they are also of great value and importance in other respects. The particular value of clover, peas, beans, vetch, and other plants of that family for adding fertility to the soil has been known for hundreds of years, although the reason why these legumes possessed superior qualities in this respect over other plants is a discovery of modern times. In his bulletin on soil inoculation Dr. George T. Moore has these interesting quotations from the writings of Pliny the elder: "The bean ranks first among the legumes. It fertilizes the ground in which it has been sown as well as any manure. The vetch, too, enriches the soil and requires no attention in its culture."

But the ancient Romans knew only the fact that these legumes acted like manure; the true reason for the fact remained a secret and baffled many investigators; and not until the year 1886 was it definitely proven that the legumes are able to acquire and store up nitrogen from the air. This discovery is ascribed to the German scientist Helriegel.

Later still, it became definitely known that this fixation of nitrogen from the air is accomplished by means of bacteria which gain entrance to the roots of the legumes. Great interest was awakened in the subject in this country when Dr. Moore of the United States Agricultural Department perfected a method of soil inoculation with the nitrogen gathering bacteria, and pure cultures were prepared and sent out to farmers in many different states. This has very naturally resulted in giving a special impetus to the growing cover-crops, which has extended even to the orchards of California. But, whatever the cause, the fruit growers are sowing peas and vetches and fenugreek in the orchards far more extensively now than was the practice fifteen years ago.

I remember that green manuring was practiced successfully by a few orange growers in Redlands years ago, but probably Mr. James Mills, superintendent of the Arlington Heights Orchards, has done more than any one else to demonstrate the feasibility of growing cover-crops in our orchards, and also the very great benefits which follow their use. Although we must admit there are difficulties in handling these crops in the orchard and not every one who has attempted it has been perfectly successful, yet I think the great and peculiar value of cover-crops is appreciated more generally to-day than ever before; and it is not too much to say that this is the best method now known for maintaining the fertility of our soils. There are many different ways in which we derive benefits from their use. Here are ten different reasons that occur to me for growing cover-crops (legumes) in the orchard:

1. They provide humus in the soil, by which the inert fertilizing materials of the soil are made available.
2. They make it possible to obtain results from the use of the cheaper forms of phosphate, such as Thomas slag and other unacidulated phosphates.
3. They store up nitrogen from the air, and therefore act as a direct nitrogenous fertilizer.
4. They improve vastly the mechanical condition of the soil, making it easily possible to secure the best cultivation.
5. They put the soil into a condition to retain moisture.
6. They make the soil porous, so that proper aëration is secured.
7. They are a means for overcoming irrigation, hardpan and plow sole.
8. While growing, they prevent the washing of the soil by the storm waters.
9. While growing, they probably assist in preventing the radiation of heat from the ground in time of a freeze.
10. They do away with the cultivation of the ground during the winter months.

NITROGEN.

It is evident, I think, that in any plan for fertilization in this semi-arid region, the humus content of the soil must be given first consideration. If humus is deficient, it must first be supplied. After it is supplied the foundation is laid for the use of chemical fertilizers, if required; but to apply chemical fertilizers in a soil exhausted of its humus may possibly work more harm than good.

It is, of course, understood that when we have grown cover-crops and obtained our humus, we have at the same time added materially to our supply of nitrogen. We have added to the soil whatever nitrogen may have been obtained from the air by the cover-crop, and further we have restored the proper conditions for nitrification in the soil.

Whether the quantity of nitrogen so obtained is sufficient, or, in other words, whether we may rely solely on green manuring for our supply of nitrogen, will depend possibly upon the kind of crop we desire to fertilize. If it be an orange or lemon crop, I think we must certainly add nitrogen in some other form. Perhaps an analysis of the matured cover-crop may indicate a sufficient quantity of nitrogen for oranges or lemons, but we must remember that it is not in a form to be immediately available. We have turned under a mass of green vegetation which must first be decomposed, and its fertilizing elements changed into other forms by the action of the soil bacteria, before it becomes available to the tree as plant food. It seems unfortunate that our winter cover-crops mature so late in the season that when we turn under this mass of vegetation it is already so late that our trees can not get the full benefit of it in time to help the setting of the new crop of fruit. Just at this time of the year our fruit trees need a suitable supply, though not an excessive supply of available nitrogen; and, in order to provide the available nitrogen, it has been the practice with many growers to drag down the growing cover-crop, sow a nitrogenous fertilizer on top of it, and then plow under the green crop and the fertilizer together. For this purpose either tankage or dried blood will serve an excellent purpose, provided it is put into the ground early enough. It is very desirable for several reasons, and from every point of view, that cover-crops be plowed under early in the season, and no later than February; and I feel sure that the amount of benefit that may be derived from their use will depend very largely upon right management in this respect. If the plowing has been done early we may use a dressing of nitrate of soda a little later to good advantage, particularly if the spring weather is cold. We know that the processes of nitrification require a certain degree of warmth in the soil (Snyder says a temperature of 54 degrees to 99 degrees is the most favorable), and it is well to keep this fact in mind when considering whether to use nitrate of soda in the early spring.

There is another aspect of the matter to be noted, which is that we should not go to extremes in supplying nitrogen. If it be supplied in excessive quantities, plants and trees use it very freely, and in the case of fruit trees, we sometimes get bad results. The quality of the fruit may be injured in this way, of which we have often seen evidence in the orange. And not only is this true, but if the excessive feeding occurs about blossoming time, the growth of leaves and stems

will be promoted at the expense of the fruit buds, which then develop imperfectly, resulting in a decreased, instead of an increased, fruitage of the tree.

PHOSPHORIC ACID.

There are two other of the fertilizing elements which we must return to our soils in order to maintain their fertility, namely, phosphoric acid and potash. Nitrogen, as we have seen, promotes the growth and sustains the vigor of the tree; phosphoric acid, it is believed, promotes a large yield of fruit. My idea is that in growing fruits we should supply phosphoric acid quite generously. But the form in which we will get the most benefit from it is a question more difficult to decide; and even scientific men, after years of field experiments, are not well agreed on the subject.

If we buy superphosphates, for example, we will get a large percentage of the phosphoric acid in a water soluble form; if we buy Thomas phosphate powder, we will get a high percentage of phosphoric acid with but very little of it in soluble form; and if we buy untreated bone meal we will have a material in which a medium percentage of the phosphoric acid is water soluble, but which is all ultimately available to the tree. These three materials, together with guano phosphate, are the phosphate materials we see the most of in California.

The advantages and the disadvantages of a soluble phosphate may be stated in this way: When soluble phosphoric acid becomes distributed in the soil, a process of fixation rapidly takes place, the phosphoric acid uniting with the lime and other alkaline bases present in the soil. This process is what is commonly spoken of as "reversion." If there is plenty of lime in the soil, the lime will be the first of these alkaline bases to get the acid, and the reverted phosphoric acid is then just as valuable as it was before, because, in this form, it is still available to the roots of the trees. If, however, there is not much lime in the soil, but a good deal of iron and alumina, these bases will get the acid; which, particularly in the case of iron, would pretty effectually lock it up, and it is in this respect that possible loss of phosphoric acid takes place. You will notice, then, that there is little danger of loss by leaching, because the phosphoric acid, by the process of combination, becomes fixed in the soil, and the only loss is in cases where the soil may be very deficient in lime and very rich in iron. Soils of this character are, I think, quite uncommon in Southern California. My understanding is that our soils are, as a rule, rich in lime, and therefore we may use phosphates freely in any form without having the phosphoric acid either washed out of the soil or locked up by combination with an iron base. "But if the soluble phosphate is quickly converted into an insoluble form, it may well be asked what has been gained by all the trouble and expense of converting the insoluble phosphate into a soluble form?" This question is raised in a bulletin of the West Virginia Experiment Station, and the answer is so admirably stated that, although I have quoted it more than once, I think it will bear repetition. The author says the chief advantage is a matter of "distribution."

When the soluble phosphate is applied to the soil it quickly passes into solution, and, as the soil water is never at rest, the phosphate solution soaks through the

soil in every direction, bathing every little particle of sand and silt and clay, and gradually being deposited among them as the necessary lime is found. These deposited or precipitated particles are extremely minute, and so expose an immense amount of surface to the action of the soil water.

Then, after speaking of untreated rock and untreated bone, Professor Hite, the writer of this bulletin, says:

The greatest disadvantage of such materials is that when applied to the soil they remain where they fall. They may be scratched about more or less by the harrow or the hoe, but even if the field could be shoveled over, or run through the most improved disintegrator and mixer, the best that could be hoped for would be a comparatively inert particle here and there. The case is altogether different when the soluble phosphate is used, for the deposited particles are not only readily available when needed, but they are so thoroughly incorporated with the soil particles that they are everywhere within easy reach of the roots.

It seems to me there is another feature that might be classed as an advantage, namely, that for fruit trees the reverted form of phosphate is the very best form of phosphate we could have. This may very possibly be disputed but the di-basic, or reverted, phosphate appeals to me as being superior to the mono-basic or soluble form, and also to the other two less soluble forms.

So much for soluble phosphates. On the other hand the less soluble phosphates have the advantage of being cheaper in price, and in connection with cover-crops, or in cases where there is a plentiful supply of humus in the soil, often give good results. Professor Hilgard formerly recommended Thomas slag phosphate, and I presume would still do so. This is a four-lime phosphate which is ground to a very fine powder, and in this condition is partly available. It is thought very highly of in England, and after we succeed in getting our orchards well stocked with humus we may find it one of the most economical forms in which to buy our phosphoric acid.

One other thing ought to be said. The use of phosphate material is very necessary in our orchard practice, but to use it in large quantities where nitrogen is deficient will undoubtedly do harm. If used on plants without a sufficient supply of nitrogen present it sometimes has a burning effect, and I have known orange trees to receive similar harm which apparently was caused in this way.

THE USE OF THE SIMPLES.

We have seen that both nitrogen and phosphoric acid may produce bad effects when used separately and in excessive quantities. This is equally true of potash. To fertilize rationally it is necessary to bear in mind that no one of these fertilizing elements can fulfill by itself the requirements of the tree; they act in combination in the plant or tree, each being necessary to the others, and each supplementing the action of the others. It is evident, therefore, that caution must be used in applying these elements separately.

Perhaps the strongest argument that can be made in favor of the use of complete fertilizers is that they are, as a rule, well balanced fertilizers, intelligently prepared to meet the requirements of the given crop, and therefore are not liable to do harm, but, on the contrary, will ordinarily prove highly beneficial. The strongest argument against them lies in the matter of cost.

It is more economical to buy the "simples" than to buy complete fertilizers. We may also use these different fertilizing elements separately, and even at different times of the year under the right conditions, but in so doing we certainly should not use either one of the elements in excess, and to the neglect of the others. I think a good plan is to decide upon a ration that we think suited to our requirements for a given season, and then adhere to that ration during the fertilizing period of the year. For example, barnyard manure supplemented with bone meal is an excellent ration. Another fine ration, now much in favor, is the application of phosphates and potash (or phosphates alone) about the first of September, followed by a sowing of field peas or vetch immediately after; completing the ration in the spring by applying dried blood or tankage when the cover-crop is plowed under.

These two rations are mentioned only as examples; the point I would make is to urge the importance of having a comprehensive plan for the season's fertilizing, broad enough to fulfill all the requirements of the crop.

POTASH.

As generally understood, potash is the maturing element in fertilizers. It performs an important office in the formation of starch in the leaves and in its transference to the fleshy part of the fruit. If in liberal supply, it is supposed to add sweetness to the fruit. It also hardens up and aids in maturing the woody parts of the tree, and its importance in all these respects is universally recognized.

We have a large supply of potash in our California soils; 40,000 pounds in the first six feet of soil is, I believe, the estimate. To what extent this is available to the tree is difficult to determine, but we do know that the bulk of the soil potash is not in a form to be immediately available and only becomes available by slow degrees. We also know it has been repeatedly demonstrated by field experiments that under similar conditions, with an apparently adequate supply of inert potash in the soil, the application of a light dressing of available potash will give an increase in the crop. I suppose there is no question but that the best way to get the benefit of the soil potash is by growing cover-crops.

It may be said that a good deal of uncertainty exists among the fruit growers as to the advisability of using potash fertilizers; theoretically they are not needed, because there is a sufficient supply in the soil, and money spent for potash would seem to be money thrown away.

NO UNIFORMITY OF PRACTICE.

In this respect, as in many others, there is no uniformity of practice on the part of the growers. This is one of the reasons why the State of California has established an experiment station here in Riverside. Such questions as the potash question are to be studied by Professor Smith and his associates, and it is expected that by means of field experiments, now being carried on at the station grounds, and also in some of the orchards, results will ultimately be obtained so clear and positive in character as to serve as rules of guidance for the future. Such results will be of inestimable value to the fruit industry.

One of the important questions to be studied is the maximum quantity of fertilizers per acre that we may profitably use. Another is the most favorable time of year for applying the different forms of fertilizing materials. Another is the problem of influencing quality of crop by means of fertilization.

INTENSIVE CULTURE.

We have been considering the question of maintaining the fertility of the soil. Let us go a step farther. What is the chief object the orchardist has in view? Is it not to produce large crops of fruit of the finest and best quality? Does not this imply intensive culture? We might grow large and healthy trees, of ordinary productiveness, by simply maintaining the original fertility of the soil, but to cause these trees to produce yearly crops of fruit which shall be of maximum quantity, and of the best quality, may involve far more generous fertilization than we have ever practiced in California.

There is nothing alarming about this. In Florida experiments have been made of increasing the applications of commercial fertilizers for bearing orange trees year by year, and it is claimed that up to eighty pounds of commercial fertilizer to the tree was used with ever increasing profit.

And can we not influence quality of crop by means of fertilization? Proper and improper pruning will influence quality; proper and improper irrigation will influence quality; and so I think we may confidently believe that we may improve the quality of our fruit by fertilization. Not, indeed, by the use of any nostrums, nor secret formulas, but in a purely scientific way. Science has not exhausted herself. Science as applied to horticulture is only in its infancy, and its possibilities are beyond our ken.

As production increases, the question of profitable fruit raising may become more and more serious, but of one thing we may be certain—there will always be a demand for the best fruit. "There will always be room at the top." Our conditions for successful fruit culture are of the very best. We live in the best country under the sun; we have the best climate under the sun; we have the best people under the sun; and we shall fall short of our high privilege if we fail to produce the best fruit under the sun.

PRESIDENT JEFFREY. We will now have discussion by Prof. Ralph E. Smith, of the Southern California Pathological Station, at Whittier.

PROFESSOR SMITH. Mr. Palmer's paper has well shown the general condition of the fertilizer question. We all know that the question of the application of fertilizer through our citrus orchards is a very open one, and still certain things are known while a great many others are not.

It seems to me that citrus production has two important phases at present. One is the financial profit. We want to grow oranges to sell and get as much for them as possible. While other considerations come in, that, after all, is the main question, to grow as many oranges

and as good oranges as we can on a given acreage on a given outlay, and get as much money for them as possible at the least expense.

We have an index to the success of our various growers in various districts and associations, and that is found in the daily papers every day where we find a column which is headed "Daily Citrus Reports of Eastern Markets." If we look over the list every day we see these differences. In this morning's "Times" we see the first brand sells for $3.35 and the last one on the list for $1.40. There is a difference of $1.95 a box. The ability to control the factors which brought about those differences is the feature of supreme importance in growing and selling oranges. One was selected and was a better quality of fruit by selection. One was a fancy or extra fancy and the other a low standard.

Now, there is another factor besides the selling price. Two or three weeks ago I happened to be over in Salt Lake City, and I examined the condition of oranges. I found that you could not buy oranges of good quality there for less than fifty cents a dozen. I watched the markets, and I watched the oranges at a certain fruit stand, and very often a certain orange would stay there for several days. The price was too high and the quality was too low. So, I do not think it is desirable to look for the highest price all the time. In my opinion it is more important to decrease the cost of production than to increase the selling price. We must look more to economy of production than to high prices.

Fertilization is one of the most important factors. It is not the only factor, but it is a very important one. At the end it comes down largely to the difference between the general and the specific, and it is a very important, or a very doubtful question which is more important, the perfection of the general or the perfection of the specific; that is to say, whether it is altogether desirable to try to show people that they can put on a certain thing and a certain amount and leave out everything else and get certain results. And the question comes up whether it is not desirable to advise the use of a complete fertilizer. It is quite doubtful at present whether there is not more danger with the average grower in advising him to use single elements than there is in advising the use of some good commercial fertilizer.

Now, the citrus experiment station is established for the benefit of the citrus industry, and has already begun considerable work in regard to this problem of fertilization. We are experimenting on a large number of trees by the use of different elements—nitrate of soda, phosphoric acid, potash, and other things.

I find in this well-known book compiled by B. M. Lelong, on "Citrus Culture," an article by Professor Hilgard on "Fertilization," in which he says:

> A question wholly aside from those discussed above, is that of the special modification of crops by the use of a surplus of certain substances known to produce a specific effect. Thus, common salt is known to make asparagus and some other vegetables more succulent and tender; nitrogenous matter increases the size and succulence of fruits, and some experiments made with potash fertilizers on oranges, point to an increase of sweetness thereby. It is, then, simply a question whether or not purchasers appreciate such modifications sufficiently to render their attainment a profitable undertaking, apart from any increase of the crop or the maintenance of soil fertility.

In a book written by Dr. Marshall Ward, the English botanist, on "Diseases of Plants," he says that the greatest advance in the last decade in agriculture is the recognition of the plant itself as a central figure, and not the climate or soil or other factors of its environment, and he goes on to depreciate the importance of agricultural chemistry, and brings out the supreme importance of the plant itself. He compares it to a factory. He says if we had a factory we might keep track of what went in at the doors and what came out as the finished product, but we would not be aware of what went on in the inside.

I have taken too much time already, and I thank you for your attention.

MR. JAMES MILLS. This paper by Frank L. Palmer is a classic on this subject in this State. I commend it to every grower in the State. He has stated the question so clearly, and with such intelligence, that it can not be improved on and won't be improved on for many years to come. Every grower everywhere ought to read Frank L. Palmer's paper, and it ought to be sent to them. It is a classic, Mr. Chairman. I never heard such a paper. It commends itself to me, and I commend it to everybody.

PRESIDENT JEFFREY. We are now ready for the next paper, "Date Growing in Southern California," by Prof. S. C. Mason.

DATE GROWING IN SOUTHERN CALIFORNIA.

By SILAS C. MASON, Arboriculturist, Plant Life History Investigations, Department of Agriculture.

Date growing is doubtless one of the oldest of horticultural industries, its culture by the Egyptians 2000 years B. C. being well authenticated by tablets and hieroglyphics, and by the Assyrians at a period much more remote. Assyrian wall tablets, long misunderstood, are now recognized as showing the pollination of the date tree as an important ceremonial. And, indeed, it may well have been so regarded, for as the blighting of the corn tassels by the hot prairie winds of western Kansas or Oklahoma means the failure of the corn crop, so any failure in the critical process of artificially pollinating the date flowers with male flowers from separate and perhaps distant trees may mean the loss of their only food crop to thousands of people of the desert regions. Few people who purchase dates as a confection realize that they are one of the world's staple food crops, and the timber afforded by the date palm trunks the main dependence of large numbers of people in the erection of their rude dwellings and villages.

Few trees in cultivation are so peculiar in their requirements or so restricted as to the area of their profitable productiveness. Like most woody plants of cultivation, the date varieties are not reproduced true from seed. Unlike our common exogenous fruits, as, for example, the navel orange or the Bellflower apple, where a single twig may afford buds from which twenty new plants true to the variety may be propagated, the date tree has, except in rare instances, no branches, but

only the terminal bud putting forth the enormous compound leaves, and a limited number of suckers or offshoots from the base of the trunk. These offshoots constitute the only means of propagating the variety, and as they should be three or four years old before being removed from the parent tree, and as their production ceases by the time the tree is fifteen or twenty years old, we see how slow and expensive a matter it is to get a date garden established, and that the danger of a rush into the date growing industry and consequent overproduction is not great.

CLIMATE.

In climatic requirements the date demands great heat, long sustained, and a dryness of atmosphere found only in almost rainless regions. A clear distinction must be drawn between localities where the date tree may be grown as an ornamental and those where the fruit may be successfully grown and ripened. In southern Florida, along the Gulf of Mexico and along the Pacific coast from San Francisco southward, the winter temperatures are sufficiently mild and the summer heat great enough to permit the growing of beautiful specimens of the date tree, yet the summer temperature is not high enough and the humidity too great to permit the development of the fruit.

Only regions of such extreme heat and dryness as are found in the Sahara, the Persian Gulf countries or the valley of the Euphrates of the Old World, have proved successful date producing territory. Careful botanists have computed that the zero point of the date tree, as far as flowering and fruiting is concerned, is 18 degrees C., or 64.4 degrees F., and Dr. W. T. Swingle, in Bulletin No. 53, United States Department of Agriculture, has shown that where the excess over this in mean daily temperature added together for the growing period of from May 1st to October 31st approximates 1,500 degrees to 2,000 degrees, with the requisite sunshine and dryness of atmosphere, early varieties of dates may be ripened.

With an excess amounting to from 2,800 to 3,300 degrees for this period, as at Cairo, Egypt, and Biskra, in Northern Sahara, date culture becomes a standard industry, numerous varieties of medium earliness and quality being produced in commercial quantities. At Phœnix, Arizona, an excellent example of similar climate, seedling dates, many of them of very fair quality, have ripened for many years.

With 3,800 to 4,200 heat units for the growing season in the hotter Sahara oases and at Bagdad, the choicest long season varieties of dates such as the Deglet Noor, Menakher, and Kustawi (S. P. I. No. 8,738), are produced, fruits sold as delicacies rather than as staples, and commanding such retail prices as our choicest candies and bonbons. Analogous climatic conditions and high number of heat units characterize the Coachella and Imperial valleys of Southern California, where we may yet expect to see these fruits produced in quantities to satisfy our entire demand.

Dr. Swingle regards the area in the United States where date culture is a possibility as comprising the hot interior valleys of Central California, the Salton Basin, the valley of the Colorado to the Nevada line, a small portion of the Mohave Valley and Death Valley, the lower Salt and Gila River valleys and a small area of the lower Rio Grande Valley

in Texas. In the cooler portions of this territory only the early, quick maturing sorts could be expected to succeed, while in the hotter portions of the lower Colorado Valley and the Salton Basin it has been demonstrated that many of the varieties requiring the longest season may be successfully matured.

But though at home in the fiercest heat in which any vegetation grows the date palm endures a greater degree of cold than the orange, possibly about the same as the olive, a fact probably due to the tough, fibrous nature of the leaves and tissues and the protected position of its single terminal bud. There are a number of date palms about Indio that are known to have survived a minimum of 15 degrees F. with little if any injury, and old seedling trees are growing in the neighborhood of Phœnix and Tempe, in Arizona, where minima of 12 and 13 degrees have been recorded during their history.

From the heat requirements of the date palm it is natural to conclude that it is also a drought resistant plant, but it is not more so than the Washingtonia or desert fan palm of Southern California, which, while a native of the hottest canyons and washes surrounding the Salton Basin, delights to grow with its roots in a snow fed streamlet which may sink into the sands a mile farther out, but lacking this will be found where there is a slow seepage and permanent moisture, though this may be of too salty or alkaline a character for the traveler's use.

Like the fan palm, the date palm must have an assured supply of moisture in order to exist and a generous supply if fruit is to be perfected. Its root system closely resembles that of the Washingtonia, as it develops in a few years' time a powerful system of round cord-like roots of great penetrating power, and able to reach considerable depths for a water supply. Seedling date trees near Indio, which have had no irrigation for a year and a half, have continued to make good growth, bore fruit last year, and are flowering and setting fruit at the present time. These are along the line of a heavy mesquite growth, and it is known that surface wells are obtained at a depth of from fifteen to twenty feet. It is only reasonable to suppose that the date roots have penetrated to layers of permanent moisture.

The nature of the soil will have much to do with the water supply demanded by a date plantation, the very sandy soil at the Mecca garden requiring much more frequent irrigation than soils of a clay or adobe nature. The well provided for this 10-acre tract is an artesian well, bored about 500 feet deep and with a 3½-inch casing, inside diameter. The flow is approximately 150 gallons per minute, or 216,000 gallons per day of 24 hours. This is equivalent to 12½ miner's inches, as usually reckoned. It has seldom been necessary to operate the well for more than the 8-hour day, even during greatest summer heat, but as the trees develop in size the demand will be greater. Dr. Swingle quotes French authority for the daily need of date trees in northern Sahara as from 126 to 180 gallons per tree per day, at the source of supply, but with a considerable loss calculated for seepage and evaporation.* With the water distributed in pipes, or tile or cement

*A report from Mr. E. F. Chumard, in charge of a plantation of Deglet Noor date trees, on heavy adobe land near Heber, in the Imperial Valley, indicates that he uses approximately 126 gallons a tree daily during the growing season of six months, May to October, inclusive, applied direct to the orchard without allowance for seepage or loss.

conduits, as in the orange groves of Riverside County, a great saving in the requirement per tree is effected.

At the Tempe Coöperative Date Garden in a heavy adobe soil, but surrounded with alfalfa fields which are copiously irrigated, the soil water has raised so that the trees have received no direct irrigation for a year and a half. While this provides for the water requirements of the orchards, of the effects on the ripening of the fruit I will speak a little later.

SOIL REQUIREMENTS.

That dates may be grown upon a great variety of soils has been fully demonstrated in this country, as well as in their home, but we still have to gain much experience as to soil adaptations of different varieties.

At the Tempe garden growth of all varieties upon the brown adobe soil of the Salt River bottoms is very rank and luxuriant, and the production of fruit all that could be expected. It is evident, however, that the ripening of the fruit is a good deal retarded by moisture which the soil retains, and it seems evident that many varieties of fruit are of a more soft syrupy nature grown here than in the dry hot sands at Mecca.

A situation where the drainage is bad and irrigation or flood waters not readily removed should be avoided. With the heavier soils it is very important that baking and cracking should be prevented by prompt cultivation as soon as the ground can be worked after irrigation. In short, good drainage and aëration of the soil are as essential to the date as to ordinary crops.

ALKALI RESISTANCE OF DATE PALMS.

The alkali resistance of the date is very remarkable, it ranking as the most resistant plant in cultivation, even exceeding the Australian salt bush. Old well-established trees are able to endure a much greater strength of alkali than young seedlings. The old trees may seem to be much more resistant than they really are from the fact that alkali accumulations on the upper layer of soil, which is usually turned by the plow, may become very heavy with little injury if the roots can penetrate to subsoils having a comparatively small percentage of the poisonous salts. This is very noticeable in the Tempe garden at the present time. The plantation was made in 1900 on land where alfalfa had been killed out, and similar to lands which Thomas H. Means, of the Bureau of Soils, had found to contain about 2½ per cent by weight of harmful soluble salts in the upper 12 inches. At the present time there is a marked alkali crust over the whole area, and the problem of keeping down weeds is practically eliminated, for few attempt to grow. Young plants from seed sprouting under the trees turn brown at the surface of the soil and die before the end of their first summer. The caretaker has been unable to surround his house with any shade trees, a single pomegranate bush being the only woody plant besides the dates able to survive in the enclosure. The fact that the ground water rises very quickly when the surrounding alfalfa fields are irrigated shows that there is a free movement of water in the substrata, probably a part of the great Salt River subflow, and the date roots are doubtless grow-

ing in a soil with a low per cent of alkali and not liable to stagnation. Dr. Swingle has shown in Bulletin No. 53, formerly referred to, that date trees do not thrive if the soil at all depths contains more than 0.6 per cent of alkali. He also shows that water of a per cent of saltiness or alkalinity that would be fatal to ordinary crops may be used in the irrigation of the date tree provided good drainage is afforded. In this discussion it should be remarked that only the so-called white alkalies, the chlorides and sulphates are referred to. While the date is in a degree resistant to the black alkali, sodium carbonate, but a very small per cent of it could be tolerated.

These facts regarding the date palm are of the utmost economic importance in relation to the development of Southern California. In both Coachella and Imperial valleys, with climatic conditions equal to any in the world for the production of dates, there are hundreds of acres of land backed by an adequate supply of water either from artesian wells or from the Colorado River, where the surface soil is somewhat too strong in alkali for the growth of any known field crop, yet where the date would thrive most admirably.

CULTURE AND MANAGEMENT.

In its cultural requirements the date palm is the most unique and interesting, perhaps, of any tree yet introduced into this country.

Dioecious in character, except in the case of occasional rare examples,* that is, bearing the male and female flowers on separate trees, a miscellaneous plantation of seedlings would on the average contain about half of each, and as the date is wind pollinated, and the pollen impalpably fine and light, the fruiting blossom would mostly receive pollen and an abundance of fruit be set. As an economic proposition, however, in a plantation of choice varieties, such a number of male trees could not be afforded when a few would furnish all the flowers necessary to pollinate the whole grove if the work is done artificially, so in practice one male tree is set for every fifty or one hundred fruiting trees.

The seedling males differ greatly in the time of flowering, and in the amount of pollen afforded, two flowering for the first time at Mecca this spring, proving entirely sterile, the anthers being merely empty sacks. Other male trees flower so late as to be of no value, for their use upon belated fruiting flowers would only produce clusters of dates too late for ripening.

So it comes about that a male variety affording an abundance of potent pollen at a desirable season is highly valued, and offshoots from it are set instead of taking chances on seedling varieties.

With both male and female sorts the seasonable application of water has much to do with the earliness of flowering, and a tree has recently come under my notice where irrigation had been neglected earlier in the season that upon receiving an abundance of water later is just now flowering considerably out of time for the variety.

One important difficulty with the work at Tempe, Mecca, and the private enterprise at Heber, in the Imperial Valley, is the lack of a

*Two seedling trees have been noted near Tempe, Arizona, by Mr. Simmons, caretaker of the Tempe Co-operative Date Garden, bearing both male and female flowers.

sufficient number of early male flowers. Flowering begins in February, and while, in theory, last year's pollen should be used in such cases the practical keeping of it in potent condition seems to have failed in a measure with all of these cultivators.

The tying of a little sprig from a male flower into the whisk broom-like head of a female flower, as it bursts the sheath, looks like a simple process, and is; but on the intelligent doing of this at just the right time and in just the right way depends the entire date crop, and in districts on about the border line of date growing territory, late frosts, cold rains, or sweeping winds may considerably interfere with success.

Where failure has resulted the flowers may drop off early, leaving the nearly naked strings of the spike to tell the story; but in other cases they may hold on and the fruit grow, three dates to the flower instead of but one, sometimes reaching large size and a beautiful appearance, but lacking the seed and power to ripen. I have seen more than a hundred pounds of fruit of this character upon a single tree. In twelve or fourteen weeks after pollination has been accomplished one of the three ovules of the flower will start into vigorous growth, while the other two will fall behind, later on sometimes appearing as scales at the base of their successful rival. I have but once seen two perfect seeded dates ripened from the same flower.

Pollination successfully accomplished, the grower's troubles are not yet over. With young trees, whose fruiting stalks are produced near the ground, the weight of the rapidly developing fruit, a bunch sometimes weighing from 30 to 40 pounds, soon bends them over, and they must be propped up. As a precaution against birds, squirrels, rats, and sometimes the neighbor's boys, not to say the neighbor himself, the bunches are sometimes enclosed in stout screen wire bags, but some predatory "animal" occasionally eats the stalk and carries away bunch and bag, perhaps the only bunch of that variety yet fruited. It is seldom that the entire crop is menaced, as occurred at Tempe in the fall of 1906, when hordes of migratory rats invaded the plantation, and it was only by great efforts and after the killing of hundreds of them that a portion of the crop was saved.

The presence of a dangerous and destructive scale, the *Parlatoria blanchardi*, on most of the offshoots imported from the north of Africa necessitates thorough fumigation on their arrival in this country. In spite of all precautions this scale has been introduced both at Tempe and Mecca, probably in the deep crevices beneath the leaf bases, and while thorough cyanide fumigations have kept it well in check, it seems likely that the gasoline flame treatment devised by Professor Forbes will be necessary for its complete extermination. Fortunately, it spreads but slowly and seems to have no other host.*

The labor of the date orchard is pretty well distributed throughout the seasons. There is no portion of it dependent upon a heavy force of outside labor brought on for a particular period, though the gathering and packing will be the most busy time, and the hopeful cultivator

*Another genus of scale, the *Phoenicoccus marlatti*, commonly known as the Marlatt scale, has been present upon date trees at both Phœnix and Heber, but as it was confined to the bases of the leaves, seemed to do little damage. Recently, however, Mr. Chumard, at Heber, has found it in such numbers upon the bases of fruit stalks of his Deglet Noor trees as to seriously interfere with the full development of the fruit.

will be glad to have employment for considerable extra labor at that period, but his wares are not so perishable as to depend on the work of a day, as with strawberries or cantaloupes. In the distribution of the year's work date growing will compare well with the labor problem in the apple orchard or grape vineyard.

ADVERSE SEASONS.

No crop grown is more liable to destruction by untimely rains than the date crop, but the arid character of desert countries is so well established that these occurrences are rare. During last October the rainfall at the Tempe garden was 2½ inches, a quite unprecedented record. Added to this the rise of the ground water from excessive irrigation of the surrounding fields, and a period of cool nights with heavy dews, and little was lacking to insure the destruction of the crop. Many that ripened soured instead of curing out, and others started to decay while still hard upon the trees. Flies and wasps swarmed in to remind one of the plagues of Egypt. The same conditions, with less rain, began at Mecca, but before long a drying desert wind set in and the damage was stayed, though an autumn temperature below the normal prevented the ripening of considerable fruit that would have matured in ordinary seasons.

There seems no doubt that the increased humidity due to the proximity of the Salton Sea, only a half mile distant, had a retarding action on the ripening of the fruit.

In the Tempe garden fruits were ripened in commercial quantities two years ago, though the rats destroyed a considerable part of the crop. Those sold, chiefly of the varieties of Rhars, Tedalla, and Birket el Haggi, brought 25 cents to 40 cents per pound, put up in neat one pound cartons.

The choice and late Deglet Noor has not yet been successfully ripened at Tempe. Fair specimens of this were secured at Mecca last year in spite of the October rain, and I recently tasted very good Deglet Noor dates from the private plantation at Heber, in the Imperial Valley. Several of the new varieties from the M'Zab region of Algeria gave very finely flavored dates in small samples last year. The present season promises to show fruits of many more varieties, and among them several bunches have been pollinated of the rare Menakher variety secured by Mr. Thomas H. Kearney from Tunis, and of which there are but three or four specimens living in the United States. This superb variety, Mr. Kearney states, is seldom placed on the market, even in Tunis, "being reserved for the tables of the wealthy natives and for gifts to their friends."

CHARACTERS OF DATE FRUIT.

Different varieties of dates differ greatly in the amount of sugar or syrup they contain. There are the soft, sticky dates which we are accustomed to see upon the market, and others still so soft and syrupy as not to admit of export, but which are eaten fresh or preserved in jars of their own syrup. Still others, the choicest of all, as the Deglet Noor and Menakher, are rich in sugar and of a delicate flavor, but are dry and firm enough to admit of packing in long strings upon their

own stems in fancy packages and command truly fancy prices. The third type, or dry dates, are so far known in this country only to those familiar with the experiment station results. Sometimes classed as bread dates, some varieties of them might very properly be called cooky dates or wafer dates. So hard as to avoid all stickiness, somewhat sugary, yet with a distinctly wheaty taste and an agreeable date flavor which can not be copied, they possess those agreeable qualities which call for "more" to that degree to which the great bakery and biscuit companies are always striving to bring their products, yet the eating of more does not bring the cloyed sensation which follows eating more than a few of the rich soft dates. Of this class of dates are the Kenteeshy, Kerza, and an unnamed variety which have given us excellent fruit, and a number of similar or reputedly better varieties yet to be fruited. These are medium early in maturing and less affected by unseasonable rains than the soft varieties. At the same time they are heavy bearers and easily kept.

I have offered them to but few people who failed to like them with the first trial, and it seems to be a liking which grows. With the American habit of buying something to nibble upon, whether peanuts, popcorn or the latest new package article compounded from both, I predict for this type of dry sweet dates an immense and lasting popularity as soon as our public comes to know them.

An item of great importance in favor of American grown and packed dates over the Arabian is brought out by Mr. David G. Fairchild, in Bureau of Plant Industry Bulletin No. 54, Persian Gulf dates, in which he says, page 29, "No old inhabitant thinks of eating a date without first thoroughly washing it in a glass of water unless the cook has prepared it beforehand, and the sale of dates in America might fall off decidedly were it generally known how intimately the unwashed hands, bodies and teeth of the notably filthy Arabs often come in contact with the dates which are sold by every confectioner."

SEEDLING DATE VARIETIES.

In the production of seedling date varieties lies a most fascinating field for the desert experimenter. Nearly every early settlement in the Southwest had a few old seedling date trees, either from seeds of imported fruits from the markets or from the old stock introduced at an early day by the missions. Some of these are of very excellent quality. In not a few instances trees bearing choice fruit have passed the offshoot producing stage, and no way is known by which the variety may be propagated. At Phœnix, Arizona, owing to the intelligence and skill of Mr. and Mrs. Lount, two varieties, perhaps the choicest that have originated in Arizona, have been preserved and a number of offshoots set out.

A new seedling, recently discovered at a ranch in the Gila Valley near Gila Bend, is of such superior flavor and earliness as to make it a variety of great promise for propagation for the shorter season districts of the date growing area. One decidedly good early variety has developed among a seedling row of about twenty trees on a ranch near Indio.

From the Mecca garden the department gave out to the settlers in

the Coachella Valley about 6,000 two-year-old seedling date trees last year, as well as a large quantity of seeds of choice varieties. The plan is to have the seedlings set in such a manner that with the elimination of most of the male trees as soon as their character is shown by the flowers and the discarding of the worthless fruiting varieties after a sufficient test, there will still remain enough of fairly good sorts that with a little shifting will occupy the ground at twenty to thirty feet apart.

There is a trade of considerable importance at Phœnix and Tempe in fresh seedling dates grown in the neighborhood, with the demand always beyond the supply. There can be but little doubt of the possibility of such a trade in Southern California sufficient in volume to justify the expense of seedling growing, while there remains over and above the certainty of some choice native grown sorts that will add greatly to the future resources of the community.

PEDIGREED SEED.

There still remains the fascinating problem of the production of pedigreed date seed, by the breeding of male trees of known parentage.

It is well known that with seedling fruits not coming true to the variety there is still a following of the type, a block of Winesap apple seedlings, for instance, being strongly of the Winesap type. In the case of diœcious types of plants, the seedlings of Deglet Noor dates, for example, will have only half of Deglet Noor blood, the male parent being a nondescript variety of unknown parentage, useful only to effect the pollination of the female flowers. But let us select as a pollen producer a vigorous Deglet Noor seedling and we have a known half of Deglet Noor blood on the male side. Continue to pollinate in this line the Deglet Noor flowers and we shall secure graded up stock—3-4, 7-8, 15-16—according to the law of stock grading, till a male tree of nearly pure Deglet Noor blood, except for the tendency to variation, is obtained.

With such bred up male trees from the choice date varieties for pollen bearers we shall be able to direct the tendencies of crosses and breed seedlings for earliness, hardiness, or for fine flavor or characteristics of fruit with some degree of precision.

As the leading apple varieties grown in America to-day are of American origin I am convinced that the American date gardens of the future will, more and more, contain American bred varieties.

PRESIDENT JEFFREY. The next paper will be on "Some Points in the History of Caprification in the Life History of the Fig," by Walter T. Swingle, also of the Department of Agriculture.

SOME POINTS IN THE HISTORY OF CAPRIFICATION IN THE LIFE HISTORY OF THE FIG.

By WALTER T. SWINGLE, Physiologist, Plant Life History Investigations, Department of Agriculture.

As some of my hearers may not be familiar with the figs of the Smyrna type, I shall preface my remarks with a short account of this remarkable fruit tree.

OUTLINE OF THE LIFE HISTORY OF THE FIG.

The fig, like the cottonwood, the carob, the pistache, and some others, exists in two forms, male and female. The female trees alone bear fruit, and the male trees, or capri figs, as they are called, produce pollen, which, when carried to the flowers of the female trees, cause the fruits to set and fertile seeds to develop.

From this point on, the complications begin that make the life history of the fig one of the most interesting chapters in natural history. The pollen is carried from the male flowers of the capri fig tree to the female flowers of the ordinary fig tree exclusively by a very small wasp-like insect, the *Blastophaga psenes*. The fig tree is absolutely dependent on the visits of this insect for a crop of seeds, and in its turn the *Blastophaga* can live and breed only in the capri figs. This mutual dependence, or symbiosis, as naturalists call it, is one of the most striking cases known and dates back to somewhat remote geological epochs.

The capri fig tree bears fruits that, at first sight, much resemble ordinary figs, and which though seldom edible, finally soften and fall off. If a capri fig be cut open before it ripens fully it will be seen to be full of grains that look much like seeds. These grains are minute galls, each one of which contains a fig insect. Finally, when the insects are ready to cut their way out of the galls, the mouth of the capri fig opens, and a ring of male flowers, situated just below, begins to shed pollen abundantly. The female *Blastophagas* (which alone issue from the capri figs) get coated with this pollen as they crawl out, and carry it to the female flowers which line the young budding figs on the female trees. The dusting of the female flower with pollen causes the fruit to set and to bear fertile seeds.

Now the capri fig tree in order to support the *Blastophaga* must bear a succession of capri figs; in most fig-growing countries there are three generations of capri figs, called respectively the winter, spring, and summer generations, often known by their Neapolitan names—*mamme, profichi*, and *mammoni*. Though it is a deciduous tree, the capri fig must carry a crop of nearly ripe but dormant capri figs through the winter on its bare branches.

The true nature of the fig and capri fig trees as outlined above has been obscured by the fact that many varieties of the female or ordinary fig tree bear abundant crops without any pollination, and hence the *Blastophaga* is not needed in growing such varieties (which happen to be just the ones which alone are grown in central and northern Europe and in the New World). Ordinary figs are analogous to navel oranges, which, having no pollen, likewise produce fruit without being pollinated, and, like navel oranges, have no fertile seeds.

It was only when the culture of Smyrna figs was attempted in this State, a quarter of a century ago, that it was realized that something was wrong, and it was only eighteen years ago that it was finally proved that figs of this class set no fruit unless pollinated.

In the orchards about Smyrna, in Greece, about Naples, in Algeria, in Portugal, and in many other localities in the Old World capri figs containing *Blastophagas* ready to come out are suspended in the branches of the fig trees to facilitate the transfer of pollen by the insect. This operation is called caprification.

ANCIENT HISTORY OF CAPRIFICATION.

The operation of caprification dates back to remote antiquity. Already in the time of Herodotus, in the fifth century B. C., caprification was so well known as to be used as a self-evident example in explaining (falsely, as it happened in this case,) the artificial pollination of the date palm as practiced in ancient Babylon.

Aristotle, in a little-known chapter of his History of Animals (Bk. 5, Ch. 26), written about 340 B. C., gives a short account of the process that could scarcely be improved to-day. He said:

> The fruits of the capri fig contain small animals called *psenes*. These are at first small grubs, and when their envelopes are broken, *psenes*, which fly, come out; they then enter the fruits of the fig tree and the punctures they make there prevent these fruits from falling before they are ripe. So the countrymen take the trouble to put branches of the capri fig in the ordinary fig trees, and also plant capri figs near the common fig trees.

Theophrastus, a pupil of Aristotle, gave a still fuller account of the operation, and was the first writer to mention that some sort of figs set fruit without being caprified. All of the later Greek and Latin writers on natural history refer to caprification as a well-known horticultural process.

Recent studies of Solomon Reinach, the celebrated Oriental scholar, go to show that caprification was very well known in the earliest Greek times before written history began. His researches led him to think that in the earliest times there was a sacred mystery play—a cult of the fig tree and of caprification analogous to the Eleusinean mystery play, in which the wheat head played the principal rôle. He thinks that the word sycophant, still a part of all modern languages, originated in these rites, and was, indeed, applied to the priest who at the critical moment during the ceremonies showed the fig branch (*syco*=fig, *phanein*=to show) just as the analogous priest, the hierophant, in the rites of Demeter, showed the wheat head. The cult of the fig he supposes to have degenerated in early times so that the sycophant, once respected and feared, came to be a cheap charlatan; hence, the modern significance of the word. If Reinach's views are correct, the cult of the fig must have been of great antiquity, for it to have become degenerated and almost forgotten before the classic Greek period.

Again, in ancient Rome, there are traces of important ceremonies that date back to the semi-mythical times of Romulus and Remus wherein capri fig branches were in a midsummer festival (about the time caprification would be practiced in that latitude). Now caprification is unknown in central Italy, and has doubtless been forgotten for many centuries about Rome,* yet at the very dawn of history we find signs that caprification was once practiced there.

Strabo, the great Greek geographer, attended school when a lad some 2,000 years ago near the present town of Aidin, the center of the Smyrna fig industry. Now, Strabo reports that in his day the figs of that region were highly esteemed and brought the highest price in the markets. This record goes to show that fig culture has been the principal industry in this region for two millennia, the oldest fruit industry

*The great naturalist, Pliny, did not have any personal knowledge of caprification.

of which we have any record, for the date orchards that were the admiration of Herodotus at Palmyra and Babylon perished ages ago.

These few examples suffice to show that in beginning the practice of caprification the fruit growers of California are reviving an operation older than the recorded history of mankind.

HISTORY OF CAPRIFICATION IN CALIFORNIA.

As noted above, it was not until the culture of Smyrna figs was attempted in California as a result of Mr. G. P. Rixford's introduction of cuttings in 1880 and 1882, that it was realized that something was lacking, and not until Mr. Geo. C. Roeding, in 1890, and Dr. Gustav Eisen and Mr. E. W. Maslin, in 1891,* first artificially pollinated Smyrna figs that it was proved that caprification was absolutely necessary with this type of figs. This new Californian point of view was first published in convincing form by Dr. Gustav Eisen in a bulletin of the California Academy of Sciences issued January 11, 1896,† which attracted wide attention both in this country and in Europe. It should be noted that after the elaborate investigations of Gasparrini made at Naples from 1845 to 1865, which resulted in his denying the efficacy of caprification, botanists and educated men generally the world over had come to consider caprification to be merely a peasant's superstition analogous to the hanging of horseshoes in favorite fruit trees to make them fertile.

The result of Eisen's memoir was to change all this and convince the scientific world that caprification was after all no idle folly, but a vitally necessary operation in the culture of drying figs of the Smyrna type. As I shall show later on, the successful introduction of the *Blastophaga* into California was brought about largely through Dr. Eisen's memoir.

INTRODUCTION OF BLASTOPHAGA INTO CALIFORNIA.

The first introduction of the *Blastophaga* was made by H. E. Van Deman, then Pomologist of the Department of Agriculture, who, in the spring of 1890, imported capri fig cuttings from Asia Minor, some of which had fruits attached from which issued the first fig insects ever seen in the New World. Some of these cuttings, and doubtless some of the *Blastophagas*, were sent to California.

The second introduction was made in the spring, and the third in

*Dr. Gustav Eisen informs me, since this lecture was delivered, that as early as 1874 his attention was called to the necessity for caprification for figs of the Smyrna type by Dr. John Bleasdale, a Catholic priest, who had been educated in Portugal, and who was familiar with caprification. Becoming convinced of the need of caprification, Dr. Eisen read a paper before the Fruit-Growers' Convention as early as November, 1885, describing the operation. His views led him into a controversial correspondence with Dr. H. H. Behr of the California Academy of Sciences during the years 1881 to 1885. The artificial pollination of Smyrna figs was discussed as a means of proving the necessity for caprification, then strenuously denied by Behr and many others, including Mr. E. W. Maslin.

Dr. Eisen "had no opportunity of trying direct pollination (from want of capri fig pollen) until 1891, in the last days of July." At his request, Mr. E. W. Maslin accompanied him to the orchard of James Shinn at Niles, California, where pollen from a "Bulletin" capri fig tree (introduced in 1880 or 1882 by Mr. G. P. Rixford) was transferred to young Smyrna figs, causing them to "come to perfection as large, ripe and luscious figs, in every way perfectly developed, with numerous perfect seeds." The experiments of Dr. Eisen at Niles were, therefore, the outcome of discussions begun many years before.

†Eisen, Gustav, Biological Studies on Figs, Capri Figs and Caprification, in Bull. Cal. Acad. Sci. (2) 5: 897-1003, Jan. 11, 1896.

the summer of 1891 by Mr. James Shinn of Niles, who received from a missionary resident in Smyrna capri figs from which the insects issued after arrival. They failed to get established, though they were liberated in a large "Bulletin" capri fig growing on Mr. Shinn's place at Niles.

The fourth introduction was made in 1892 by Mr. F. Roeding of Fresno, who received from Mr. Thomas Hall of Smyrna in June and July several shipments of capri figs from which *Blastophagas* issued but failed to get established.

The fifth introduction was made in the early spring of 1895 by Mr. Geo. C. Roeding, who received from Mr. Anthony C. Denotovitch, then traveling in Asia Minor, a package of capri figs in good condition, from which, however, the insects never issued.

The sixth introduction was made in March and April, 1898, by me. I was studying caprification at Naples at the time, and sent a number of packages of capri figs to the Department of Agriculture at Washington, D. C., from where they were forwarded to Mr. Geo. C. Roeding at Fresno. The earliest shipment reached Fresno on April 15th, but though the *Blastophagas* came out, they failed again to establish themselves.

The seventh and last, the finally successful introduction, was made by me in March, 1899, when I sent from Algiers a number of packages of capri figs, the first of which reached Mr. Geo. C. Roeding on April 6, 1899. These insects entered the young capri fig buds on a number of trees, bred there and established themselves permanently in California.

HISTORY OF THE FINAL AND SUCCESSFUL INTRODUCTION OF BLASTOPHAGA INTO CALIFORNIA.*

As there have been some misunderstandings as to how my introductions came to be made, I thought the fruit growers of this State would perhaps be interested to know just how they happened.

I spent the spring of 1896 in Naples, and while there had the pleasure of making the acquaintance of Prof. Paul Mayer, one of the foremost European students of caprification. I was busy with other work at that time, however, and did not attempt any detailed work on the fig.

However, in March of 1898, I was again in Naples, where I enjoyed the facilities of the International Zoological Station through the courtesy of the director, Prof. Anton Dohrn. In the mean time I had read Dr. Eisen's memoir on caprification, and, happening to see the operation being carried out on a capri fig tree a day or two after my arrival, I decided to study anew the whole subject of caprification in a region where it was a standard horticultural practice. At that time I had never been in California, and all I knew about California conditions I learned from Eisen's paper. I was abroad on leave of absence, paying my own expenses, and undertook the work wholly on my own initiative and at my own expense. During the course of my work I never received any suggestions from California or from anywhere in America, for the simple season that I did not myself know when I sailed, early in March, just what I would do at Naples, and

*In this sketch I have not considered the introduction of the fig insect, which occurs in the wild figs of Mexico, as these insects can not live in the capri fig.

after I went into the work there was not time for my letters to reach me even if any had been sent. I had, at that time, not yet seen the now famous letter of the State Board of Trade, signed by Mr. E. W. Maslin, Mr. J. A. Filcher, and Mr. B. N. Rowley, and received no instructions from the Secretary of Agriculture or any one else. I am forced to make this public disclaimer in view of the mistaken statements that have been published in this State as to the inception and conduct of my work.

While working at Naples I did have the benefit of the advice of Prof. Paul Mayer, and of Count Solms Laubach, also a famous student of figs and caprification.

After looking into the matter for a few days I decided to try to send the *Blastophaga* to California in the firm winter generation capri figs, which could be shipped in March when the weather at Naples was still cool. My first shipment, containing capri figs whose cut stems had been waxed and which were wrapped simply in tinfoil and shipped by samples post, were sent to Washington and reshipped from there, reaching Mr. Geo. C. Roeding in Fresno on April 15th. Insects issued from the capri figs, and as soon as I learned this I was sure I could succeed in establishing the *Blastophaga* by my method, for I had found, on studying the matter, that there was a great range in the time of ripening of the winter generation capri figs, which could be had all the way from the oases of the Sahara desert to Botzen in Southern Tyrol. I did not hope to strike the right season in California the first time, and as a matter of fact the winter generation capri figs from Naples and Smyrna ripen too late in spring to reach California at the proper time.

In July, 1898, I entered the service of the newly established section of Seed and Plant Introduction, of which Mr. David G. Fairchild was in charge.

My letter of instructions from Secretary of Agriculture James Wilson authorized me to continue my work on caprification, and accordingly, in March, 1899, I went to Algiers, where, with the amiable coöperation of Dr. L. Trabut, Government Botanist of Algeria, I soon found abundant capri fig trees laden with the nearly ripe winter generation capri figs. I shipped them in the same manner as the spring before, and my first shipment reached Washington, D. C., on March 31st, when it was reshipped by Dr. L. O. Howard, reaching Mr. Geo. C. Roeding on April 6th. A capri fig tree at Fresno was covered with cheese cloth and the insects liberated inside the tree.

Little attention was paid to the tree after this until June 23, 1899, when Mr. John C. Jones in collecting pollen from capri figs for the artificial fertilization of a few Smyrna figs found a capri fig containing male *Blastophagas* and still unopened galls containing female *Blastophagas*. Of course, the tented tree was now given immediate attention. Most of the insects had escaped, but a few capri figs were found still full of *Blastophagas*, some more were found on an adjoining tree, and a few distant parts of the orchard, proving that some of the insects had escaped from the tent when liberated in April and had found other capri fig trees in which they had bred.

The insects managed to get established in the summer generation capri figs and by November 10th, when I visited the orchard, thousands

of *Blastophagas* were present and were then entering and laying eggs in the young buds of the winter generation capri figs. During the following year, 1900,* the *Blastophagas* were abundant enough to be of use in caprifying and producing the first crop of figs ever produced by the splendid Smyrna fig orchard which had been for many years kept up at a total loss—a standing monument to Mr. Roeding's faith in the ultimate success of the industry.

I might say that after making my first efforts to introduce the *Blastophaga*, in the spring of 1898, I received many suggestions, but neither the California growers nor the entomologists of Washington had any faith in my system, being of the opinion that a small tree covered with capri figs should be dug up and shipped over. The trouble was, as I soon found, that it was impossible to find young and small capri fig trees bearing winter generation capri figs. Only large trees bore them, and the expense of moving them would have been enormous.

Another drawback, not realized by its adherents, of this plan, is that for reasons to be given later only rarely if ever can the *Blastophaga* breed the year round on a single tree, and the chances of its living in a tree weakened by a long voyage would be almost nil. The net result of sending over a large rooted tree, bearing winter generation capri figs, would, therefore, have been merely to land the *Blastophaga* in this country. It would still have had to seek breeding places in other capri fig trees, so that, after all, nothing more would have been accomplished than by sending a half dozen capri figs wrapped in tinfoil by samples post at a cost of a few cents.

"It's an ill wind that blows nobody good," and one good result of the lack of faith in my method of introducing the *Blastophaga* and subsequent neglect of the infected tree was that the principal parasite, or, rather, messmate of the fig insect, *Philotrypesis ficaria*, which in the Old World often takes up one third or even one half the space in the capri figs (and which can not caprify the figs at all), failed to get established in this country, so California has the only simon pure colony of *Blastophaga* in the world. It would be a calamity if any further introductions were made, as there would be grave risk of introducing *Philotrypesis*, which if once here could not be exterminated.

NEW POINTS IN THE LIFE HISTORY OF THE FIG AND CAPRI FIG.

In a lecture on Caprification, delivered before the Marine Biological Association at Woods Hall, Mass., on August 14, 1899, and again in a paper published in October, 1899,† I called attention to the fact that the *Blastophagas* that issue from the spring generation capri figs (in June in most countries) enter the young budding figs of the female or fertile fig tree, though they can not breed or even lay their eggs there. However, if the female *Blastophaga* were intelligent enough to

*From the middle of March to the end of September, 1900, Mr. E. A. Schwarz, a most competent and conscientious entomologist and naturalist, stayed at Fresno studying the *Blastophaga* and caprification. These studies published in part only in Dr. L. O. Howard's paper "Smyrna Fig Culture in the United States" (Yearbook, U. S. Department of Agriculture, 1900, pp. 79-106, pl. 1-8) are the most complete ever made on the life history of the fig insect, and have also cleared up many points in the natural history of the fig and capri fig.

†"The Dœcism of the Fig in its Bearing upon Caprification," in Science, New Series, Vol. 10, pp. 570-574, No. 251, 20 October, 1899.

discriminate between the budding capri figs in which she can deposit eggs and the ordinary fig buds in which she can not, then no figs would be caprified, no seeds would be formed, and soon the fig species would die out, and with it the *Blastophaga*, that can breed only in the capri fig.

EXPLANATION OF THE BREAK BETWEEN THE SPRING AND SUMMER GENERATIONS OF CAPRI FIGS.

Just here is to be found the explanation of the decided break that all observers have noticed between the ripening of the spring generation capri figs (*profichi*) and the budding out of the young summer generation capri figs (*mammoni*). This break is so pronounced that when I began studying caprification, one very acute observer, who had spent several years studying horticulture in countries where caprification was practiced, assured me that I must seek some other host plant for the *Blastophaga* at this critical season, and suggested that it would be found breeding in some of the bushes that clothe the hills in the Mediterranean region. The ink-gall insect, somewhat related to the *Blastophaga*, does go from one species of oak to another in its home in Syria.

However, already, in 1882, Dr. Paul Mayer had pointed out that the insects that issue from very late *profichi* or late varieties can enter the very first *mammoni* buds to push on the earliest varieties of capri figs.*

Countless thousands of *Blastophagas* do, however, come out of the spring generation capri figs too early to enter even the earliest summer generation capri fig buds (*mammoni*), though just in season to enter and pollinate the young buds on fertile fig trees.†

BLASTOPHAGAS FORCED TO ENTER YOUNG FRUIT OF THE FERTILE FIG.

Natural selection has, therefore, brought about that even an intelligent *Blastophaga* would find no suitable capri fig to enter, but must finally in desperation crowd into an ordinary fig bud propelled, doubtless, by a powerful instinct prompting it to deposit its eggs.

The break between the spring and summer generations of capri fig fruits has, therefore, the object of compelling the *Blastophagas* to enter and pollinate the young buds of the fertile fig tree, then pushing in the greatest abundance.

It must be remembered that in a state of nature wild fig trees of both sexes would grow intermixed, and that the break between the spring and summer generations of capri figs would in the absence of artificial

*Mayer, Paul, Zur Naturgeschichte der Feigeninsecten (The Natural History of the Fig Insect) in Mittheilungen a. a. Zool. Station zu Neapel, 3 : 551-590, pl. 25, 26, Nov. 4, 1882.

†It was a realization of this fact which caused me to rely entirely on winter generation capri figs (*mamme*) in attempting to introduce the *Blastophaga* into this country. They arrive early in spring, and, if sent at the right time, find abundant spring generation capri figs in receptive condition, whereas the spring generation capri figs if shipped to California arrive just during the break between the spring and summer generation of capri figs and stand a very small chance of finding a breeding place. Then, too, such spring generation capri figs must be shipped during hot weather, whereas the winter generation capri figs make the voyage in March.

When I began to ship the winter generation capri figs to California I found there was no adequate realization here of the great advantage of sending this generation rather than the more abundant and better known spring generation.

caprification be a powerful aid in causing the fertile trees to be pollinated.

Now, in orchard culture of figs of the Smyrna type, where all caprification is performed artificially, the female *Blastophagas* have no choice but to enter the Smyrna fig buds. In commercial fig culture it would be an advantage to have capri fig trees that did not show any break between the spring and summer generations of insects, as it would be much easier to keep up a full supply of the *Blastophaga*.

NEW TYPE OF CAPRI FIG TREE ORIGINATED BY MR. E. W. MASLIN.

By a most curious coincidence, within a few days after I first thought out this point, in August, 1906, and communicated it to Prof. S. C. Mason, who was then studying caprification in California, he found just such a capri fig in the Maslin orchard at Loomis, Placer County, California.

In 1885, Mr. E. W. Maslin planted the seeds of the best grade of Smyrna figs to be obtained in the market. Several hundred of these seedlings were set out in orchard form on his place at Loomis. This orchard was not a commercial success, and it was soon noticed that many of the trees were more like capri figs than Smyrna figs. In the fall of 1899 I found several promising capri figs there and in the summer of 1906 Professor Mason found a very curious variety, a sort of hermaphrodite tree, that had enough of the qualities of a capri fig to support the *Blastophaga* and enough of those of the fertile fig tree to produce an abundant crop of summer generation buds just as the spring generation capri figs were ripening. It also bears numerous fertile seeds mingled with the insect-bearing galls.

By planting this variety among the other capri figs the *Blastophaga* will be able to breed uninterruptedly throughout the year and not, as is now the case, almost completely die out in midsummer.

THE CAPRI FIG ORCHARD.

It is clear from what has preceded that the *Blastophaga* has a very much better chance of breeding in a special capri fig orchard composed of a number of varieties. Some sorts of capri figs not particularly valuable for use in caprification, may, nevertheless, be extremely valuable in furnishing suitable breeding places for the insect at some critical season, as, for instance, the new variety noted above from Mr. Maslin's seedling fig orchard.

Since March, 1898, I have realized the importance of securing all obtainable varieties of capri figs, and this object has been kept steadily in view ever since. A number of capri figs were secured by me in Naples in 1898 and others in 1899 in Algeria, Greece, and Asia Minor, and in 1901 Mr. Carl S. Scofield made a special trip to the fig region in the Kabylie Mountains of Algeria to secure the many capri figs that occur there. I secured some of the Italian sorts in 1902. In the mean time the Maslin seedling orchard has pointed out a way to obtain still more and ultimately still better sorts.

BREEDING NEW AND SUPERIOR FIGS AND CAPRI FIGS.

There is nothing to indicate that the Smyrna type of fig is very highly bred or very widely different from the wild type of figs. On the contrary, among even the few dozen edible figs secured by Mr. Maslin, there are several that are equal, if not superior, to the commercial Smyrna variety.

This being the case there is every reason to expect to secure very superior varieties of drying figs and of capri figs by growing large numbers of trees from seeds of the best varieties pollinated by all the different capri figs. It must be remembered that the hereditary character of the capri fig come into play in this breeding work, and that we might as well expect to improve the grade of Durham cattle with a scrub bull as to breed new and superior types of drying figs while using a poor type of capri fig. The hereditary character of capri figs can be seen only in the offspring, so we are forced to try as many different capri figs as possible in the hope of securing one that yields progeny of the highest order of excellence. This is another reason for securing all obtainable varieties of capri figs, as it by no means follows that the capri figs best adapted for artificial caprification on a commercial scale will be those yielding the best new sorts among their progeny.

NEW TYPES OF FIGS TO FIT AMERICAN CONDITIONS.

It is confidently expected that within a few years many of the several thousand seedling figs now growing will have fruited, and that comprehensive plans will be matured that will permit of the breeding of types of figs and capri figs especially well adapted to American conditions. In such work use will be made of the seventeen species and subspecies of figs of the Carica group known to botanists. Some of these wild figs are hardy in the climate of Washington and others are extremely drouth resistant. In other words, the improvement of the fig has only just begun and fig culture is still in its infancy in this country.

PRESIDENT JEFFREY. Mr. F. P. Hosp is not here, and his paper will be read by Mr. Leonard Coates, of the northern part of the State. I take pleasure in introducing Mr. Coates.

THE EUCALYPTUS, FOR USE AND ORNAMENT.

By F. P. HOSP, of Riverside.

In the second half of the fifties the first Eucalypti were planted in California as well as in Southern Europe; the species used was mostly *Eucalyptus globulus* or blue gum.

There are some 150 or more known varieties of this Australian tree, which is bound to become one of the best assets before long in the products of the Pacific coast.

Not only are our climate and soils the very best adapted for its successful growth, but, as travelers and investigators say, they are superior to that of its original home.

As may be expected of such a large number of species, some differ

more or less in their local requirements, as they do in their individual characteristics and merits as producers of timber, kino, oils, etc.

The Eucalypti are fast growing trees. *Eucalyptus globulus*, or blue gum, is said to be the fastest growing tree in the world. Now, how is it that all or most of the hills in California are lying bare and idle and treeless? It is only of late, since a great railroad corporation has shown by its enterprise and faith in timber growing, that the public is waking up and taking an interest in this vast and highly profitable industry.

One asks, "How long have we to wait for returns?" Ask them the same question when one takes a life insurance policy. It does not take a wizard to point out the best of the two investments. If it pays to grow pine forests, how much more does it pay to grow Eucalypti, requiring only about one fourth of the time to mature to merchantable size, and when cut it will grow up again two or threefold?

An acre, when planted to trees, certainly doubles in value the first year. You need not pay one hundred dollars per acre for raw land to grow trees on. You do not need to irrigate excepting far inland or on high ground. Prepare the land by plowing; plant 8 by 5 or 7 by 6 feet apart; water each plant; this will be sufficient. Cultivate once or twice the first and second years. The third year the trees should meet and cover the ground completely and thus protect themselves; the sooner you attain this result the better. Young plants being easily and cheaply raised, it would be poor economy to plant sparingly. By the time the grove or forest is five years old, cut out every other tree. These will furnish posts, poles, barrel hoops, fuel, etc. After this thinning 500 or 600 trees will be left to the acre.

The varieties of Eucalypti differ as much in regard to extremes of temperature as to their requirements of humidity. *Eucalyptus rostrata* (red gum) is about the hardiest in this respect. It succeeds in temperatures ranging from 10 degrees to 120 degrees Fahrenheit. It grows in dry as well as low and swampy lands. *Eucalyptus corynocalyx*, or sugar gum, one of the best, is more tender, and while young suffers if temperature goes below 26 degrees. It likes high ground, and stands drought. *Eucalyptus resinifera, E. tereticornis, E. citriodora, E. pilularis*, are good growers, and furnish excellent, durable hard wood for ship building, bridge and railway ties, poles, carpentering, flooring, etc.

The wood of *Eucalyptus globulus*, or blue gum, is not durable under ground; checks and twists easily; is much used as fuel, and numerous instances testify to a yearly return of $200 per acre.

The ironbarks, *Eucalyptus orebra, E. paniculata*, and *E. sideroxylon*, are not as fast growers as the above named, but their wood is the very best and almost indestructible.

The Eucalyptus also takes a front rank as an ornamental and decorative tree. For larger parks here it really is the backbone of plantations. The varieties greatly vary in size, many shadings of the bark and foliage, and, finally, the gorgeousness of the brilliant flowers of some of them, make it as great a favorite with the plant lover as with the landscape gardener.

It is a peculiarity with fine flowering kinds that they are mostly of smaller growth, ranging from a bush to a small tree, thus making them

well adapted for undergrowth of the larger growing species. The varieties of this class include: *Eucalyptus foecunda, E. ficifolia, E. miniata, E. tetraptera, E. calophylla,* etc.

As a street tree *Eucalyptus polyanthema* leads, while *Eucalyptus viminalis, E. rudis, E. corynocalyx* and others are shapely growing trees, well adapted to grace our public highways.

PRESIDENT JEFFREY. I wish to thank the people of the Convention for the kindness shown your Chairman. I thank you all. The meeting is now adjourned.

J. W. JEFFREY,
President.

JOHN ISAAC,
Secretary.



LIBRARY OF CONGRESS
00009169659

